IN THE

Supreme Court of the United States

OCTOBER TERM, 1978

No. 78-1216

BRITISH AIRWAYS BOARD,

Petitioner,

vs.

THE BOEING COMPANY,

Respondent.

APPENDIX TO THE PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE NINTH CIRCUIT

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Opinion

UNITED STATES COURT OF APPEALS

FOR THE NINTH CIRCUIT

No. 76-3373

BRITISH AIRWAYS BOARD,[1]

Appellant,

vs.

THE BOEING COMPANY,

Appellee.

November 8, 1978

Before:

CHAMBERS and HUFSTEDLER, *Circuit Judges,* and RENFREW,* *District Judge.*

RENFREW, *District Judge:*

Appellant BOAC appeals from an order of the United States District Court for the Western District of Washington granting appellee The Boeing Company ("Boeing") summary judgment in a suit arising out of the crash of a Boeing 707 near Mt. Fuji, Japan, on March 5, 1966. BOAC, which owned and operated the plane, had sued Boeing for damages, alleging negligent design and manufacture,

[1] This lawsuit was originally brought by British Overseas Airways Corporation ("BOAC"). In response to a suggestion from this Court, counsel for BOAC filed a motion to substitute British Airways Board, BOAC's successor in interest, as plaintiff and appellant. We granted this motion on August 17, 1978. For the sake of clarity, plaintiff-appellant is referred to as BOAC in this opinion.

* Honorable Charles B. Renfrew, United States District Judge for the Northern District of California, sitting by designation.

breach of express and implied warranties, and strict tort liability. On appeal, BOAC contends that the district judge should not have granted summary judgment, because there existed a "genuine issue of material fact" which remained to be resolved at trial, and because all discovery in the case had not been completed. In addition, it claims that the change of venue from the Central District of California to the Western District of Washington was improvidently granted. We hereby affirm the decision of the trial court.

History of the Case

This suit was initially filed on May 18, 1973 in the Southern District of New York.[2] After Boeing raised an affirmative defense based on the statute of limitations, BOAC filed a substantially identical "protective" suit on November 9, 1973 in the Central District of California. Both suits were transferred to the Western District of Washington pursuant to 28 U.S.C. § 1404(a) on motion of appellee Boeing.[3]

After completion of preliminary discovery, BOAC moved for partial summary judgment on the strict tort liability claim. Boeing opposed the motion and filed a cross-motion

[2] On September 23, 1966, six and one-half months after the plane crash, BOAC and Boeing agreed that no claim for damages would be filed until the final passenger and crew claim against the airline had been disposed of, and that the statute of limitations applicable to the damage claim would be extended for a period of two years following the conclusion of the last passenger or crew claim. This action was commenced in timely fashion since the last claim was disposed of in November, 1971.

[3] Boeing's motion to transfer venue in the California action was granted on April 30, 1974. Its motion to transfer venue in the New York action was granted on May 24, 1974, after the Court of Appeals for the Second Circuit denied BOAC's petition for a writ of mandamus to halt the transfer.

for summary judgment seeking dismissal of the complaint in its entirety. Both parties filed briefs in support of their motions. Oral argument was heard on September 10, 1976. On September 23, 1976, the trial court denied BOAC's motion for partial summary judgment and granted Boeing's motion for summary judgment dismissing the complaint. It concluded that:

> "1. The probable cause of the accident in question was abnormally severe Clear Air Turbulence which imposed excessive loads on the aircraft beyond its design limits.
>
> "2. Although there is undisputed evidence of some fatigue failure in the fin attachment fittings on this aircraft * * * there is no evidence indicating that the crash resulted from, or was caused, in whole or in part, by such failure. Instead, the evidence supports the finding * * * that cracks in the fin fittings were not an accident cause factor.
>
> "3. Plaintiff has been unable to produce any evidence that a contributing cause of the accident was a defect in the aircraft."

This appeal followed.

I. *Venue*

BOAC's first argument on appeal is that the trial court in the Central District of California abused its discretion in transferring venue in the action to the Western District of Washington. In ruling on Boeing's motion for summary judgment, however, the court below had two suits before it, the California "protective" suit and the suit initially filed in the Southern District of New York. Because the

Court of Appeals for the Second Circuit has upheld the transfer of venue from the Southern District of New York to the Western District of Washington, the trial court had at least one of the suits properly before it and we must dismiss BOAC's argument on this issue as moot.

II. *Genuine Issue of Material Fact*

BOAC and Boeing have different theories as to the cause of the airplane crash. BOAC claims that the accident resulted from defective design and manufacture of the fin attachment fitting of the aircraft[4] which caused the tail of the plane to crack and then to separate in flight. Boeing argues that the accident was due, not to design or manufacturing defects, but to the effect of severe air turbulence encountered when the plane's pilot flew close to Mt. Fuji at too low an altitude.

On appeal, BOAC contends that whether or not its theory is correct, it has at the very least demonstrated a "sharp and substantial dispute" as to the existence of material facts. Specifically, it contends that there is a factual dispute as to whether on the day of the accident there was clear air turbulence ("CAT") in the vicinity of Mt. Fuji of a magnitude in excess of the design strength of the aircraft, and whether, regardless of the clear air turbulence, the crack in the vertical fin attachment fitting was the proximate cause of the crash.[5]

[4] The fin attachment fitting is that part of an aircraft which holds the tail (the vertical stabilizer or fin) to the fuselage. BOAC Opening Brief, at 11 n.5.

[5] In its brief, BOAC stated that there were actually six issues of disputed fact:

> "1. Whether the subject aircraft which crashed on March 5, 1966 had inherent design or manufacturing defects when it was sold to BOAC by Boeing;

Rule 56(c) of the Federal Rules of Civil Procedure provides that summary judgment is appropriate where "there is no genuine issue as to any material fact and [where] the moving party is entitled to judgment as a matter of law."[6] The burden of establishing that there is no genuine issue of material fact lies with the moving party, in this case Boeing. *Mutual Fund Investors* v. *Putnam Management Co.*, 553 F.2d 620, 624 (9 Cir. 1977); *Doff* v. *Brunswick Corp.*, 372 F.2d 801, 805 (9 Cir. 1966), *cert. denied*, 389 U.S. 820, 88 S.Ct. 39, 19 L.Ed.2d 71 (1967); 6 Moore *Federal Practice*, ¶ 56.15[3], at 56-463. However, once Boeing has met that burden by presenting evidence which, if un-

> "2. Whether at the time Boeing sold the aircraft to BOAC fatigue cracks existed in the terminal fin attachment fittings of the subject aircraft;
>
> "3. Whether abnormally severe clear air turbulence, exceeding the design strength of the aircraft, was present at the time of the disintegration of the subject aircraft while in straight and level flight;
>
> "4. Whether the vertical fin attachment fittings failed in flight under normal conditions causing the entire vertical fin to separate from the aircraft resulting in the disintegration of the subject aircraft;
>
> "5. Whether the manufacturing and design defects were the proximate cause of the disintegration of the subject aircraft while in straight and level flight;
>
> "6. Whether the accident was caused by abnormally severe clear air turbulence which imposed gust loads in excess of the design strength of the aircraft." BOAC Opening Brief, at 14-15.

[6] In reviewing the district court's order granting Boeing's summary judgment motion, we apply the same rule as applied below, *i.e.*, whether there is any genuine issue of material fact. *See Pacific Fruit Express Co.* v. *Akron, C & Y R. Co.*, 524 F.2d 1025, 1029 (9 Cir. 1975), *cert. denied*, 424 U.S. 911, 96 S.Ct. 1107, 47 L.Ed.2d 315 (1976); *Inland Cities Express* v. *Diamond Nat. Corp.*, 524 F.2d 753, 754 (9 Cir. 1975); *Radobenko* v. *Automated Equip. Corp.*, 520 F.2d 540, 543 (9 Cir. 1975).

contradicted, would entitle it to a directed verdict at trial, Rule 56(e)[7] shifts to BOAC the burden of presenting specific facts showing that such contradiction is possible. *See First Nat. Bank* v. *Cities Service Co.*, 391 U.S. 253, 288-290, 88 S.Ct. 1575, 20 L.Ed.2d 569 (1968) (noting absence of "significant probative evidence" in support of contradictory theory); *Mutual Fund Investors* v. *Putnam Management Co., supra,* 553 F.2d at 624; *Stansifer* v. *Chrysler Motors Corp.,* 487 F.2d 59, 63 (9 Cir. 1973). This is the burden that BOAC has failed to meet, even though we have drawn all permissible inferences from the evidence in its favor. *See United States* v. *Diebold, Inc.*, 369 U.S. 654, 655, 82 S.Ct. 993, 8 L.Ed.2d 176 (1962) (*per curiam*); *Stansifer* v. *Chrysler Motors Corp., supra,* 487 F.2d at 63; 6 Moore *Federal Practice,* ¶ 56.15[1.00], at 56-405.

Boeing produced substantial evidence that any preexisting fatigue crack in the fin attachment fitting was irrelevant to the cause of the accident. First, it introduced BOAC's official accident report (Incident/Accident Report No. 558) which stated: "The fin fitting was released to Boeing for detailed metallurgical examination and they concluded that these cracks were not an accident cause factor." Boeing Exhibit D-1, at 5. Second, it noted that BOAC's Chief Investigator of Accidents and its Air Safety Advisor had both testified in depositions that neither they nor anyone they knew of disagreed with the findings of this

[7] Rule 56(e), as amended in 1963, provides in pertinent part:

"When a motion for summary judgment is made and supported as provided in this rule, an adverse party may not rest upon the mere allegations or denials of his pleading, but his response, by affidavits or as otherwise provided in this rule, must set forth specific facts showing that there is a genuine issue for trial. If he does not so respond, summary judgment, if appropriate, shall be entered against him."

metallurgical examination. Boulding Deposition, at 36-39; Nisbet Deposition, at 87-89. Finally, it pointed out that both the investigator for the Royal Aircraft Establishment and Boeing's Chief of Structures Research had testified that the crack in the fitting was irrelevant to the cause of the accident. Boeing Exhibit D-8; Boeing Exhibit D-6 ("there was no indication from the examination of the wreckage that the failures had been associated with any premature structural failure or malfunction of the aircraft systems").

If BOAC had produced evidence which contradicted these facts, or even evidence from which contradictory inferences could be drawn, we would be constrained to rule that summary judgment was inappropriate. However, after diligently searching the record, and after seeking the assistance of counsel at oral argument, we are unable to find any evidentiary support for BOAC's position.

BOAC attempted to meet its burden under Rule 56(e) with two pieces of evidence. First, it introduced the deposition testimony of a Boeing employee that a crack in the terminal fitting *can* lead to a catastrophic accident.[8] However neither that witness nor any other witness produced by BOAC has been able to produce specific facts showing, or even creating an inference, that the crack *did* lead to the accident in question. The only statements we can find in the record that the crash was caused by a defective fin attachment fitting were made by counsel for BOAC. But legal memoranda and oral argument are not

[8] "Q. [A] crack in a critical part such as a terminal fitting can lead to catastrophic failure of the aircraft, isn't that correct?

"A. If not found and properly removed, it would result in complete failure." BOAC Motion for Partial Summary Judgment, Exhibit 15 (Morgan Deposition), at 50, lines 6-10.

evidence, and they cannot by themselves create a factual dispute sufficient to defeat a summary judgment motion where no dispute otherwise exists. *Smith* v. *Mack Trucks, Inc.*, 505 F.2d 1248, 1249 (9 Cir. 1974).

Second, BOAC attempted to avert summary judgment by relying on the report of the Japanese Civil Aeronautics Board ("JCAB"), the agency which investigated the crash. Among other things, the JCAB found that the vertical stabilizer of the tail fin and the left horizontal stabilizer broke away before the rest of the aircraft disintegrated. BOAC claims that this supports an inference that the aircraft first broke apart at the fatigue cracks and that the fatigue cracks therefore caused the crash.[9] However, examination of the aircraft showed that at least *five* in-flight failures had occurred. And in fact, the JCAB report ultimately concluded that *"it was not possible* to establish the break-up sequence of the major portions of the entire aircraft." BOAC Motion for Partial Summary Judgment, Exhibit 8, at 21 (emphasis added).[10]

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[9] Of course, this fact can only be considered material if the CAT did not exceed the design strength of the aircraft. *See* pp. 8-9, *infra*.

[10] BOAC's reliance on the JCAB report is somewhat surprising in that the report fully supports the theory put forth by Boeing that unusually severe CAT, and not a design defect, was the proximate cause of the accident. The JCAB concluded in its report:

> "The evidence provided by the aircraft wreckage, the injuries to the victims and the evidence from the color film suggest that the aircraft suddenly encountered abnormally severe gust loads exceeding the design limit load over Gotemba city and disintegrated in the air in a very short period of time."

Moreover, the report specifically states:

> "The probable cause of the accident is that the aircraft suddenly encountered abnormally severe turbulence over Gotemba city which imposed a gust load considerably in excess of the design limit."

A party opposing a motion for summary judgment must introduce "sufficient evidence supporting the claimed factual dispute * * * to require a jury or judge to resolve the parties' differing versions of the truth at trial." *First Nat. Bank* v. *Cities Service Co., supra,* 391 U.S. at 288-289, 88 S.Ct. at 1592; *United States* v. *Gossett,* 416 F.2d 565, 567 (9 Cir. 1969), *cert. denied,* 397 U.S. 961, 90 S.Ct. 992, 25 L.Ed.2d 253 (1970); *McGuire* v. *Columbia Broadcasting System, Inc.,* 399 F.2d 902, 905 (9 Cir. 1968). A mere scintilla of evidence will not do, for a jury is permitted to draw only those inferences of which the evidence is reasonably susceptible; it may not resort to speculation. *See Mutual Fund Investors* v. *Putnam Management Co., supra,* 553 F.2d at 624; *Miller* v. *New York Produce Exchange,* 550 F.2d 762, 767 (2 Cir. 1977), *cert. denied,* 434 U.S. 823, 98 S.Ct. 68, 54 L.Ed.2d 80 (1977); *Wolf* v. *Reynolds Electrical & Engineering Co.,* 304 F.2d 646, 649-650 (9 Cir. 1962). Therefore, because we find that BOAC has presented no evidence on which the trier of fact could legally support its theory of the case, we must affirm the decision of the trial court as to this issue.

Even if we were to hold that an inference could be drawn from a very selected portion of the JCAB report sufficient to withstand Boeing's motion for summary judgment, we would still be constrained to affirm the trial court. Boeing, too, had a theory explaining the cause of the plane crash. It posited that the plane encountered CAT which was so severe that it exceeded the design strength of the aircraft and caused it to disintegrate. If this theory is supported by uncontradicted evidence within the meaning of Rule 56(c) and (e), then the factual "dispute" regarding the defective fin fitting becomes immaterial. If the CAT exceeded the design strength of the plane, there would have been a major air disaster whether or not the

fin attachment fitting was defective. And if the factual dispute is immaterial, it cannot be held to bar the granting of summary judgment. *Mutual Fund Investors* v. *Putnam Management Co., supra,* 553 F.2d at 624.

The record contains considerable evidence as to the presence of unusual CAT in the form of a "mountain wave" on the day of the crash. The Aircraft Incident/Accident Report No. 558, prepared by BOAC, quotes from the portion of the JCAB report which concludes that the evidence "suggests that the aircraft suddenly encountered abnormally severe gust loads exceeding [its] design limit load * * *" and that this was the "probable cause of the accident." Boeing Exhibit D-1, at 1-2. The BOAC report also quotes the conclusions of the Meteorological Office, Bracknell, to the effect that

> "[a] strong mountain wave situation existed over Honshu [on the accident date]. * * * [T]here is considerable support for a case of wave resonance to the lee of Fujisan with the possibility of a rotor, in the vicinity of Gotemba where the accident is thought to have occurred * * *." *Id.* at 8-9.

In addition, BOAC published in the July, 1968 issue of Air Safety Review a reprint of a report of a former United States Navy fighter pilot who was an eyewitness to the meteorological conditions existing at the time of the accident. Prefaced by an editorial comment that "[i]n March 1966, a BOAC 707 was destroyed in the air by an extreme mountain wave generated by Mt. Fuji * * *," the report noted that as the pilot neared the crash site he was immediately "tossed about * * * violently * * * [and] batted around by the turbulence in the lee of Mt. Fuji." Boeing Exhibit D-4, "An Encounter with Severe CAT." Finally,

the December 1970 issue of Air Safety Review contained a summary of the findings of the Chief of the First Research Division of the Physiometeorological Research Department of the Japanese Meterological Institute. This summary also supported Boeing's theory that air turbulence caused the accident. Boeing's Exhibit D-7.

In an attempt to contradict this evidence, BOAC relied on the testimony of two witnesses. First, it noted that its Air Safey Advisor, Captain Thomas Nisbet, testified that he had never heard of a Boeing 707 aircraft having broken up in mid-air solely as a result of meteorological conditions. Nisbet deposition, at 105. However, Captain Nisbet did not say that this breakup could never happen. All he said was that he had never *heard* of it happening. Moreover, earlier in the deposition, he stated that he had no reason to disagree with Boeing's findings that the crack was not relevant to the cause of the crash. Nisbet deposition, at 87-89.

Second, BOAC pointed to the testimony of one of its meteorologists who said that he could not believe the finding of the JCAB that a gust of a magnitude sufficient to break up an airplane could have existed at Mt. Fuji at the time of the accident. Chambers deposition, at 30-31. However, although this deposition was taken on July 26, 1976, prior to the September 10, 1976 oral argument on the summary judgment motion, it was not filed with the court until November 4, 1976, well after Boeing's motion had been granted. Because of its untimely filing and because permission for late filing was neither sought nor granted, the deposition cannot be relied upon at this late date to establish the presence of a material factual issue. *See Sound Ship Building Corp.* v. *Bethlehem Steel Co.,* 533 F.2d 96, 101 n.3 (3 Cir.), *cert. denied,* 429 U.S. 860, 97 S.Ct. 161, 50 L.Ed.2d 137 (1976); *City Electric, Inc.* v.

Electrical Workers Local 77, 517 F.2d 616, 617 (9 Cir.), *cert. denied,* 423 U.S. 894, 96 S.Ct. 194, 46 L.Ed.2d 127 (1975). And even if it could be, we note that the meteorologist later confessed that he did not actually know whether or not a strong mountain wave could break up an aircraft. Chambers deposition, at 33. His testimony, therefore, does not provide a sufficient basis for our overruling the district court's determination that no genuine issue of material fact existed.

We conclude that BOAC has failed to meet its burden under Rule 56(e) to introduce "specific facts" contradicting Boeing's contention that no genuine issue of material fact exists. After twelve years of investigation and litigation, all BOAC has come up with is supposition, speculation, and conclusory argument of counsel. Because it has presented no evidence "sufficient * * * to require a jury or judge to resolve the parties' differing versions of the truth at trial," even after all permissible inferences have been drawn in its favor, we hereby affirm the decision of the court below as to this issue. *See First Nat. Bank* v. *Cities Service Co., supra,* 391 U.S. at 288-289, 88 S.Ct. at 1592; *Bryant* v. *Kentucky,* 490 F.2d 1273, 1275 (6 Cir. 1974).

III. *Discovery*

BOAC had not completed deposing certain eyewitnesses to the accident, the Japanese investigators, and fifty-four Boeing employees at the time the district court ruled on the summary judgment motions. BOAC Opening Brief, at 35-38.[11] Alleging that these depositions would have been

[11] A Petition for Letters Rogatory and a Commission to take the depositions was pending before the court at the time summary judgment was granted.

sufficient to create a genuine issue of material fact because they

> "would establish that the design and manufacturing defects * * * were known to Boeing * * * and that these fatigue cracks caused or contributed to the disintegration of the subject aircraft[,]"

BOAC argues that the district court's failure to permit completion of discovery constituted error.[12] BOAC Opening Brief, at 36. We disagree.

BOAC's arguments on the discovery issue appear for the first time on appeal. At no point did it request the district court to stay consideration of the summary judgment motions pending completion of discovery,[13] even though the Federal Rules of Civil Procedure provided a specific means for it to do so. When a party opposing summary judgment is unable to present facts "essential to justify his opposition" to the motion, Rule 56(f)[14]

[12] None of these depositions were alleged to have any bearing on the issue of whether the plane encountered CAT in excess of its design strength. Therefore, although we have no need to reach this issue, we note that a serious question exists as to the materiality of the depositions. *See Daily Press, Inc.* v. *United Press, Int'l,* 412 F.2d 126, 135 (6 Cir.), *cert. denied,* 396 U.S. 990, 90 S.Ct. 480, 24 L.Ed.2d 453 (1969) (no abuse of discretion where additional discovery would not have affected motion for summary judgment).

[13] BOAC agreed to the September 10th hearing date on the summary judgment motion by stipulation signed on August 25, 1976.

[14] "Should it appear from the affidavits of a party opposing the motion that he cannot for reasons stated present by affidavit facts essential to justify his opposition, the court may refuse the application for judgment or may order a continuance to permit affidavits to be obtained or depositions to be taken or discovery to be had or may make such other order as is just."

authorizes him to file an affidavit setting forth his reasons. *See* 6 Moore, *Federal Practice,* ¶ 56.24, at 56-1421. If BOAC had filed such an affidavit, the district court, in its discretion, could have "order[ed] a continuance to permit * * * depositions to be taken or discovery to be had * * *." The airline can hardly argue at this late date that the district court abused its discretion in ruling on the summary judgment motion in light of the fact that BOAC itself failed to pursue the procedural remedy which the Federal Rules so clearly provided. *Cf. Mayerson* v. *Washington Mfg. Co.,* 58 F.R.D. 377, 384 (E.D.Pa. 1972) (motion for continuance to seek additional discovery denied as requirements of Rule 56(f) not met).

Furthermore, even though BOAC moved for a continuance of the trial date pending completion of discovery, it never explained to the court why the depositions were necessary. Except for the brief statement at oral argument that the uncompleted discovery would "further substantiate" BOAC's allegations that the fatigue cracks caused the accident by causing the fin to break off, BOAC never gave the court any reason to believe that the discovery would create a genuine dispute over a material fact. Even when BOAC moved for reconsideration of the court's ruling on October 1, 1976, it failed to argue that the uncompleted discovery would unearth a genuine issue of material fact. It was not until October 26, thirty-one days after the case was decided, and two weeks after it was appealed, that BOAC first suggested the critical nature of the missing depositions. In light of this delay, it is hard for us to consider the district court's failure to anticipate the significance of the depositions an abuse of discretion.

BOAC cites a number of cases in its brief for the proposition that a plaintiff should have an opportunity to conduct discovery on issues pertaining to a summary judgment motion, and that this discovery should be permitted prior to the consideration of the motion. However, these cases are distinguishable from the case at bar. For in the cases cited, plaintiffs had no prior opportunity to develop the evidence sought, and the evidence itself was critical to the issues in the case. *See, e. g., Egelston* v. *State University College at Genesco,* 535 F.2d 752, 754 (2 Cir. 1976) (dismissal of a sex discrimination case without allowing plaintiff any discovery was error); *Alghanim* v. *Boeing Co.,* 477 F.2d 143, 148 & n.9, 149 (9 Cir. 1973) (Rule 56(f) motion should have been granted to permit plaintiff time to file personal affidavit from residence in Kuwait; additional discovery allowed "[i]nasmuch as further proceedings must be had * * *"); *Ward* v. *United States,* 471 F.2d 667, 670 (Rule 56(f) motion should have been granted where there had been no discovery at all on critical negligence issue). By contrast, in the instant case BOAC had sufficient opportunity to present evidence on the causation issues to the district court. The summary judgment motions were heard in September, 1976, over ten years after the plane crash. Even if BOAC had been unable to obtain critical depositions prior to the hearing date, it should have filed a Rule 56(f) motion rather than have waited until well after the district court rendered its decision before raising the issue for the first time.

For these reasons we hereby affirm the decision of the district court denying BOAC's motion for partial summary judgment and granting Boeing motion for summary judgment dismissing the action.

Order on Summary Judgment Motions

UNITED STATES DISTRICT COURT

WESTERN DISTRICT OF WASHINGTON AT SEATTLE

Nos. C74-257S and C74-380S

BRITISH OVERSEAS AIRWAYS CORPORATION,

Plaintiff,

vs.

THE BOEING COMPANY,

Defendant.

This matter comes before the Court on plaintiff's motion for partial summary judgment on liability and defendant's motion for summary judgment. The parties agree that there are no material facts in dispute, and the Court having examined the files and records herein and having heard argument and being advised in the premises;

NOW THEREFORE, the Court finds and concludes as follows:

1. The probable cause of the accident in question was abnormally severe Clear Air Turbulence which imposed excessive loads on the aircraft beyond its design limits.

2. Although there is undisputed evidence of some fatigue failure in the fin attachment fittings on this aircraft, as well as on other Boeing 707 aircraft, which does not meet acceptable design standards, there is no evidence indicating that the crash resulted from, or was caused, in whole or in part, by such failure. Instead, the evidence supports

the finding of the Japanese Civil Aeronautics Board accepted by the responsible officers of the plaintiff, as well as the defendant, that cracks in the fin fittings were not an accident cause factor.

3. Plaintiff has been unable to produce any evidence that a contributing cause of the accident was a defect in the aircraft.

For these reasons, the plaintiff's motion for partial summary judgment is DENIED and defendant's motion for summary judgment is GRANTED.

IT IS SO ORDERED.

The Clerk of this Court is instructed to enter judgment dismissing plaintiff's action and shall forward uncertified copies of this Order to all counsel of record.

DATED at Seattle, Washington, this 23rd day of September, 1976.

/s/ MORELL E. SHARP
United States District Judge

Order on Plaintiff's Motions

UNITED STATES DISTRICT COURT

WESTERN DISTRICT OF WASHINGTON AT SEATTLE

Nos. C74-257S and C74-380S

BRITISH OVERSEAS AIRWAYS CORPORATION,

Plaintiff,

vs.

THE BOEING COMPANY,

Defendant.

Plaintiff in the above-entitled cause brings various matters before this Court, each of which is discussed separately below:

Motion to Retax Costs

Plaintiff's Motion to Retax the costs awarded to defendant by the Clerk of this Court on October 4, 1976, is hereby DENIED. This Court affirms the Clerk's determination on costs, finding the same to be appropriate.

Motion for Reconsideration

On September 23, 1976, this Court entered summary judgment for defendant, thereby dismissing plaintiff's cause of action. On October 1, 1976, plaintiff filed a timely Motion for Reconsideration of that Order. Fed. R. Civ. P. 59(e). That motion was noted for hearing on November 5, 1976. On October 12, 1976, plaintiff filed a notice of appeal. Since the Motion for Reconsideration was pend-

ing in this Court prior to the filing of the notice of appeal, jurisdiction to entertain the undisposed motion remained vested in this Court. Wright & Miller, Federal Practice and Procedure, Civil § 2821.

Plaintiff premises reconsideration on two grounds, maintaining that at the time this Court ordered summary judgment it did not have the benefit of (a) relevant depositions of Boeing employees previously noticed but not yet taken, as well as various other documents, and (b) certain other depositions of BOAC employees taken during July of 1976.

The Court finds neither ground compelling and hereby DENIES plaintiff's Motion for Reconsideration for the reasons stated in the September 23, 1976 summary judgment Order. With regard to ground (a), it should be noted that on June 4, 1976, plaintiff moved for partial summary judgment on the issue of defendant's liability, thereby initiating the process of judicial review. Defendant's summary judgment motion followed. At oral argument on the cross-motions, both parties agreed that the Court was properly in a position to rule on the liability question. Plaintiff cannot now claim that such a ruling was precipitate. With regard to ground (b), plaintiff has intimated that defendant wrongfully withheld certain BOAC employee depositions from this Court while presenting others. The Court disagrees. Defendant's motion for summary judgment was accompanied by defense counsel's affidavit which excerpted various statements from certain BOAC employee depositions. These statements were verified as accurate when compared to the actual depositions duly filed in the Clerk's office on the hearing date of the motion. The subject depositions had been procured by Boeing via a specified expedited request to the London court reporter. Defendant

had no affirmative duty to procure any documents in this manner and their efforts in doing so were toward the diligent presentation of their case. Depositions plaintiff considered relevant could likewise have been procured. Their decision not to do so cannot be attributed to defendant.

Motion to Continue the Motion for Reconsideration

On the Nov. 5th date set for hearing on the above-addressed Motion for Reconsideration, this Court received notice of plaintiff's Motion to Continue that hearing date. The basis of the request was to provide time for plaintiff to supply the Court with certain deposition transcripts claimed to be germane to the reconsideration motion. Plaintiff's Motion for Continuance is DENIED inasmuch as the subject depositions were filed with the Clerk on November 4th and reviewed by the Court. The Court finds these depositions to be unenlightening, unpersuasive, and of insignificant stature in comparison to the other materials filed in this lawsuit. The Court is still of the opinion that there are no genuine issues of material fact.

Motion to Extend Time for Transmitting the Record on Appeal

On November 8, 1976, this Court received notice of plaintiff's Motion to Extend Time for Transmitting the Record on Appeal to the Clerk of the United States Court of Appeals for the Ninth Circuit. It is the opinion of this Court that plaintiff's timely Motion for Reconsideration suspended the finality of this case for purposes of appeal until the issuance of the present Order. Consequently, the Court DISMISSES the instant motion as improperly filed.

IT IS SO ORDERED.

The Clerk of this Court is instructed to send uncertified copies of this Order to all counsel of record.

Dated at Seattle, Washington, this 15th day of November, 1976.

/s/ MORELL E. SHARP
United States District Judge

Transcript of Oral Argument Regarding Summary Judgment Motions

IN THE

DISTRICT COURT OF THE UNITED STATES

FOR THE WESTERN DISTRICT OF WASHINGTON AT SEATTLE

Nos. C74-257S and C74-380S

BRITISH OVERSEAS AIRWAYS CORPORATION,

Plaintiff,

vs.

THE BOEING COMPANY,

Defendant.

TRANSCRIPT OF PROCEEDINGS had in the above-entitled and numbered cause in the above-entitled court before the Honorable MORELL E. SHARP, United States District Judge, on Friday, September 10, 1976, at the United States Courthouse, Seattle, Washington.

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Transcript of Oral Argument Regarding Summary Judgment Motions

PROCEEDINGS

The Clerk: No. C74-257S and C74-380S, British Overseas Airways vs. The Boeing Company.

The Court: Gentlemen, I have the material which I am in the process of going through. I have read enough to agree with, I believe, both sides that there is sufficient material before the court for the court to make the liability determination in this case on the cross-motions for summary judgment.

As you know, there is a lot of material here to go through, and ordinarily we do not have oral argument in these matters because oral argument is pretty much repetitious of the matters that are submitted in the brief. But, nevertheless, this is a case that I think warrants some oral argument on these motions. So each side may have twenty minutes. You may pick out what you feel is most important to bring to the court's attention in that twenty minutes.

Mr. Pace: May it please the court, Your Honor, my name is Ronald Pace and I'm with the law firm of Condon & Forsyth in New York representing plaintiff British Overseas Airways Corporation now known as British Airways. I ask the court's permission to speak on behalf of the British Airways in this court where we have retained Bogle & Gates as our Washington counsel.

The Court: Yes, you may represent your client here.

Mr. Pace: Your Honor, the motions that have been filed for summary judgment on behalf of the plaintiff and the defendant are quite voluminous and I do not want to take the court's time in reiterating what is already set forth in the pleadings. However, I believe that we can summarize the salient points and perhaps then, if the court desires

questioning on any of the points raised, counsel for BOAC would be most happy to answer those questions.

Personally, I believe, Your Honor, that there is no problem with a number of facts, namely, that Boeing designed and manufactured a Boeing 707-436 aircraft and sold a certain Boeing 707-436 aircraft, registration GAPFE, to the plaintiff then known as British Overseas Airways Corporation in 1960.

Further, Your Honor, there is no question of fact that this aircraft, GAPFE, disintegrated in flight while performing regular line service between Tokyo, Japan and the British Crown Colony of Hong Kong on March 5, 1966.

Your Honor, it was established by the Japanese investigating authority that prior to and at the time the aircraft disintegrated in flight over Gotemba City some six miles east of Mt. Fuji, British Overseas Airways Corporation was operating its aircraft, GAPFE, properly in accordance with the regulations of Japan, further, in accordance with the regulations of BOAC's internal operational policy and, moreover, in accordance with the procedures set forth in the Boeing flight manual.

Now, the complaint of British Airways Corporation against the Boeing Company alleges, firstly, this aircraft in question was defective both in its design and manufacture at the time it was sold to BOAC in 1960 and at the time it disintegrated in the air on March 5, 1966. This defective design in manufacture consisted of the attachment fittings which are used to attach the aircraft's entire vertical fin to the aircraft and fuselage bulkhead. These terminal fittings were underdesigned, they had sustained fatigue cracks and they fractured and failed, which caused the vertical fin to separate from the aircraft in flight, which

made it impossible to continue the flight and which, moreover, then placed excessive stress loads on the remaining structure of the aircraft causing the remaining structure of the aircraft to disintegrate in flight.

The Court: Do you have any of the investigations that you can point to to confirm that this particular fin fatigue caused this disintegration?

Mr. Pace: We have, Your Honor, the Japanese investigative report which, although I admit is not admissible at trial, but I believe that that would give the indication that the vertical fin failed and came apart from the aircraft first.

The evidence on that that is alluded to in the Japanese report is the wreckage trail. Portions of the fin, including the vertical section, were found furthest away from Mt. Fuji.

The testimony of the Boeing Company in the passenger litigation that arose from this accident has stated that—excuse me, Your Honor, has confirmed that the vertical fin was found furthest from the wreckage and, moreover, has stated that it failed first.

Further on, the Boeing Company has admitted that the fractures in the terminal fittings would cause the vertical fin to separate from the aircraft under normal flying conditions and under normal loads.

Further, Your Honor, the Boeing Company has admitted in their sworn deposition testimony that the loss of the vertical fin, which is a critical component of the aircraft, would then place excessive stress loads on the aircraft causing further structural damage but, moreover, would, in and of itself, make the aircraft impossible to fly as opposed to examples given during the deposition of a loss

of a wing or a portion of a wing which, in the opinion of the Boeing Company, would not make it impossible for the aircraft to fly to safe recovery. But with the loss of the tail section, it would be impossible to fly the aircraft.

Moreover, in a separate report issued by the Royal Aeronautical Establishment, they also concluded that the vertical fin and the tail section came off first in the disintegration of the aircraft.

The Court: Even if it came off first, I didn't see any investigation, including your own BOAC report 588, that indicated that this was the cause of this particular accident. There is no question that BOAC had problems with those fins, but the question is what caused this accident.

Mr. Pace: Well, I believe, Your Honor, that your question concerning the BOAC report 558, which takes abstracts from the official Japanese report and was published in the BOAC Air Safety Review as a matter of information concerning an incident and certainly not as an official organ of company policy.

But the conclusions that were reached by Boeing, who participated in the investigation in Japan and assisted the Japanese authorities, was accepted by the Japanese authorities and, accordingly, accepted by BOAC who, although, accepting it, did not necessarily agree with it but had no other alternative since the Japanese were the ultimate investigating authority and had the ultimate word in the investigation.

But the phrase, and if I may paraphrase it, where Boeing took back the sections of the aircraft for metallurgic examination and concluded that the fatigue cracks were not a causative factor in the air crash, were accepted by the Japanese and there was no further investigation done by anyone in that regard.

Now, BOAC, as the consumer of an aircraft produced by Boeing, accepted the Boeing conclusion that these fatigue cracks had nothing to do with the cause of the crash, they had no other alternative. They listened to the manufacturer. They had listened to the manufacturer in this regard, Your Honor, for some four years prior to this accident when these fatigue cracks were first noticed and listened to the manufacturer tell them what to do and what not to do concerning these fatigue cracks. But BOAC is not in the business of making aircraft, they are in the business of flying the aircraft as properly and as safely as is humanly possible, and they had no reason to doubt the conclusions rendered by Boeing.

However, the testimony of the Boeing personnel in the passenger litigation arising out of this case, which was subsequent to the promulgation of the official Japanese report, that shed a different view from the somewhat conclusive statement that Boeing made to the Japanese investigative authority.

Then, Your Honor, we go into 1968, the accident in Mt. Lassen, California, a military configuration of the Boeing 707, where the same thing happened, and the testimony of the Boeing personnel in that litigation, which directly referred to the Mt. Fuji accident, confirmed that the conclusion reached by Boeing during the investigation of the Mt. Fuji accident was not accurate and that the terminal fittings and the fatigue cracks therein were most certainly a factor in the vertical tail separating from the aircraft in the Fuji accident and that this fatigue crack of the size and dimensions as existed on the subject aircraft in the Mt. Fuji accident would cause the vertical fin to separate from the aircraft under normal operations and under normal

loads, and Boeing further testified, Your Honor, that the terminal fittings were underdesigned, and although some four, five months after the Mt. Fuji accident in, I believe, August or September, 1966, Boeing made the terminal fittings on the 707 eight times stronger than they were prior to the day of the accident.

On the military version of the 707, the KC-135, this was not done, and again the testimony in the case, the C-135 case, refers to what Boeing did on the 707 aircraft and what they did not do to the KC-135 aircraft. But the same people who are involved with Boeing in structures, in the metallurgical testing and examination of these fatigue cracks which Boeing was aware of from 1960 at the very least, stated that these fatigue cracks most certainly would cause the vertical fin to separate from the aircraft.

In fact, they went on to say that they were quite concerned about this after the Mt. Fuji accident because they felt if this problem was not remedied and rectified as soon as possible, further catastrophes could occur.

I believe, Your Honor, that the depositions of the Boeing people today in this case will bring this out even more explicitly and more clearly.

The Court: Do you want to save five minutes?

Mr. Pace: Yes, Your Honor.

The Court: All right.

Mr. Gerrard: Good morning, Your Honor.

May it please the court, the court asked Mr. Pace whether BOAC had any evidence that the crack was related to the cause of the accident, and I submit that he did not answer that question. He did say that BOAC accepted Boeing's conclusion that the crack was unrelated because they had to accept it; that is not correct.

BOAC invited Mr. Jones of the Royal Aircraft Establishment to participate in the accident investigation, and Mr. Pace referred to Mr. Jones' report this morning, and the second paragraph of the report, which is one of the exhibits that we have submitted to the court, states, the third paragraph, "The aircraft failed under side load and there was no indication that the failures had been associated with any pre-crash weakness or malfunction."

He then goes on to say, "The very first thing that failed was the rudder, not the vertical fin," and he says, "Local sequence established that the rudder power control unit output rod failed before any other component."

Mr. Pace said well, the vertical fin failed and some sort of crash forces broke the rest of the airplane, but there's just absolutely nothing in the record to that effect. There is nothing that explains how the engines broke, why the wing broke, why the fuselage broke in half immediately in front of the wing. We have put in uncontroverted evidence, and particularly the affidavit of Mr. Smith, that the crack had to be irrelevant in view of the way the aircraft broke up, and they made no attempt to controvert that.

There is just not an awful lot more I can say about it other than they haven't, in any way, met their burden of controverting the evidence that we have put in, much of it drawn from their own reports, that suggests that—that say—that adopt that the airplane broke up because it was flown into Mt. Fuji mountain waves and broke up instantaneously, not only the fin broke, but the fuselage broke, the engines, wing, horizontal stabilizers.

I don't know what more to say than that. That's why we should go in summary judgment.

Transcript of Oral Argument Regarding Summary Judgment Motions

The Court: Counsel says, and I haven't had a chance to review the material in this respect, but apparently some of the passenger cases that followed Mt. Fuji, other material has come to light and exposed in the investigations.

Mr. Gerrard: There is no material that has come to light that I'm aware of that BOAC, which participated in the passenger cases, wouldn't have been aware of at the same period of time. There is nothing in any of the passenger cases or anywhere else that has ever tied the crack in the vertical fin attach fitting in one of them, the aft rear one, to the breakup of that airplane.

He has mentioned the Mt. Lassen airplane, that's a totally different accident. The airplane, the only thing that came off in the Mt. Lassen accident was the tail section, the engines, wings, fuselage came right straight down through the trees, none of that is in the record, it isn't in his record and it is not in our records, but since he brought it up, it was a different accident.

This airplane broke up because it was flown into forces that exceeded the design strength for the airplane, that's what the Japanese said, that's what Boeing said, that's what BOAC said, and we went over there and took their depositions, and we asked them to provide the person most knowledgeable about the cause of the accident at the depositions. At first they said well, they weren't going to provide anybody most knowledgeable as to the cause of the accident, that was for the judge and the jury, then they said, "Every witness we have was most knowledgeable about the cause of the accident." This is in the depositions that we have provided to you. Then finally they said well, we'll say that Mr. Folliard is most knowledgeable about the cause of the accident. Mr. Folliard

Transcript of Oral Argument Regarding Summary Judgment Motions

said he didn't know what the cause of the accident was but he accepted the Japanese report.

We made a motion for summary judgment a month and a half, roughly, before we go to trial. This case has been pending for a number of years, but the total cases for many, many years, and they are totally unable to come up with anything in the way of expert testimony or documents or anything else that ties that crack to the cause of the accident. Just the opposite, they don't controvert what we have said and they don't controvert Mr. Jones, who was part of the United Kingdom team over there, came over specifically at BOAC's request, and he says there is no indication that the failures had been associated with any pre-crash weakness or malfunction.

The Japanese report that they referred to says it was impossible to determine clearly how much the fatigue cracks in the vertical stabilizer rear starboard fittings contributed to the breakup. There is just no—they can't meet their burden of proof and they haven't met them.

The Court: You have five minutes, Mr. Pace.

Mr. Pace: May it please the court, Your Honor, just a few words on some of the points touched upon by Mr. Gerrard.

Firstly, I believe the court has in its exhibits the complete report by the Royal Aircraft Establishment, sometimes referred to as the Jones report. I think when the court reads the entire report, the conclusions stated by Mr. Gerrard in the summary certainly do not follow exactly as Mr. Gerrard said.

Moreover, the Royal Aircraft Establishment and any other outside agency who went to Tokyo, Japan to assist the Japanese in the investigation, any authority that came

from the United Kingdom outside of BOAC who, of course, was the operator of the aircraft and was, of necessity, there to assist in the investigation, was commissioned by the Department of Trade and Industry and the Accident Investigations Branch of the Department of Trade and Industry.

I think that Boeing places great reliance on the Japanese report and what they have referred to as the BOAC official accident investigation report on this crash.

Firstly, I believe that Your Honor will read in the depositions of the Boeing—excuse me, of the BOAC witnesses who testified this past July, and I do not know if counsel for Boeing has given Your Honor all of the depositions, we have not received them until this morning from counsel for Boeing, so I don't know exactly what has been given but, firstly, it has been manifestly clear that this report 558 was an informative report for the personnel and most particularly the operational personnel of BOAC. It wasn't a conclusory report. It wasn't a report enunciating and promulgating the official company policy of BOAC with regard to this accident, and the report was basically extractions and excerpts from the Japanese report, and as Mr. Folliard, who was chief inspector of accidents for BOAC at the time of the Mt. Fuji accident and who coordinated the investigation participation by the United Kingdom team, which was composed of the Department of Trade and Industry, the Accident Investigations Branch, BOAC and any other outside agency of the United Kingdom retained to go to Tokyo, stated that he, as chief inspector of accidents of BOAC, had to accept the report of the Japanese because it was the Japanese

who were conducting the investigation and it was within their exclusive authority.

The Court: I know, but that's not the point. The point is on these motions whether BOAC will have anything to offer linking this fracture to this particular accident.

Mr. Pace: I'm sure we will.

The Court: And what is that point?

Mr. Pace: I believe that the deposition testimony that I have attached as exhibits to our motion that was both involved in the passenger litigation arising from this accident and in the KC-135 litigation, which, although Mr. Gerrard says is a different accident entirely, it is quite surprising that the testimony of the Boeing people in that accident refers continuously, time and time again, to the Mt. Fuji accident and to this problem with the vertical fin fittings, and we believe that Your Honor will see in these exhibits, which we have attached to our motion for summary judgment, that the fatigue cracks did in fact cause the vertical fin and the other sections of the tail to separate from the aircraft as the first portion of the aircraft that separated, which made the aircraft impossible to fly and imposed excessive stress loads on the aircraft, which caused the aircraft to further disintegrate.

The Court: And how do you explain Mr. Boulding's testimony which is quoted in one of the briefs here? This deposition was taken, I think, last July.

Mr. Pace: Yes, Your Honor. I believe you are referring to where he was asked if he disagreed with the statement—

The Court: "Q. I'm asking you what you recall or do you recall any person, and I want to know who he is or she is who stated that the cracks in the fittings were the

cause of the accident or who stated that they were relevant to the cause of the accident, and if so, I want to know who the person is. Do you know of any such person?

"A. I don't know of anyone.

Q. Have you ever heard if there is such a person, whether or not you spoke to them?

A. I'm not aware of anybody who has voiced any opinion in this area at all.

Q. You have never heard if there was such a person?

A. No.

Q. Do you know of any writings that contain any facts," et cetera, and he is the chief accident investigator for BOAC.

Mr. Pace: Well, I believe, Your Honor, that it is a proper time to explain that Mr. Boulding's relationship to BOAC and to the accident in question, Mr. Folliard was the chief inspector of the accident at the time of the accident, and as Mr. Boulding has testified in his deposition, which I believe is one of the depositions that was presented to you this morning by counsel for Boeing, he stated to counsel for Boeing in his deposition that he really had nothing more to do with the investigation of this accident and to assist Mr. Folliard in specific duties, and that it was, quote, unquote, Mr. Folliard's baby and that he never followed through on the accident, but when he succeeded Mr. Folliard, who retired in November of 1966 and who made his contribution to the investigation of this accident through May of '67 in a retired posture, he immediately began to work as chief inspector of accidents for new claims, incidences and occurrences, and all he did with relation to the Mt. Fuji accident was to put in a

final form the report of Mr. Folliard concerning the accident.

The Court: I would certainly think he in his position would know whether there was any person or any writing who was voicing such an opinion.

Mr. Pace: I don't think so, Your Honor. I think that there is some misleading implications in the title both for Mr. Folliard and Mr. Boulding, chief inspector of accidents, and that's why when the testimony was given, it was stated immediately by Mr. Folliard that he was there as a liaison to coordinate the efforts of his investigative team, which composed the people from Operations, from Maintenance, from Training.

The chief inspector for accidents by his term of reference is not one who is responsible to conclude as to the cause of the accident. The chief inspector of accidents, if taken as it means and implies in England, is one who is inspecting the accident, coordinating the accident, the investigation of the accident, but is not one who is called upon to give a cause of the accident because, as Mr. Folliard stated and as Mr. Boulding stated, I don't know if it was during his deposition because that deposition was adjourned at the request of counsel for Boeing, neither man ever flew an aircraft, neither man was an aerodynamicist, neither man had expertise in structures, metallurgy, and it was their function really to coordinate the efforts of the people who had their areas of competence and responsibility in Operations, Training, Maintenance, Structures, Metallurgy, Meteorology, and then to just compile their efforts into a report, and that's why the report was not a conclusory report.

Now, the one question that I don't believe Boeing has addressed itself to, and this goes to the affidavit by Mr. Smith of Boeing and by the multiple references in Boeing's motion for summary judgment, is their theory as to the cause of the accident, the adverse meteorological conditions, and they quote the probable cause as set forth by the Japanese investigation authority, and they go on to say that the BOAC accepted this probable cause.

If one looks at the paragraph immediately prior to the probable cause in the Japanese report, which was extracted and put in the BOAC report, you will see, Your Honor, where it says that it was impossible to verify meteorologically any adverse weather conditions on the day of the accident, and yet Boeing says that the cause of this crash and the cause of the fin falling off the aircraft was caused by excessive gust loads imposed by severe clear air turbulence. There is nothing—there is not a fact in existence nowhere, not in any deposition testimony, not by implication, which says that any form of adverse meteorological conditions such as those postulated by Boeing existed on the day of the accident. This is but mere speculation and guesswork. Boeing continuously postulates this as their theory as to the cause of the accident.

But BOAC is saying that we can establish that up to the point of disintegration over Gotemba City, we had done everything that was required of us on behalf of the BOAC operations and on behalf of the manufacturer of Boeing and on behalf of the Japanese authorities. The plane broke up in the air, the fin failed first, and we believe that the next statement, i.e., that the fatigue cracks in the terminal fittings caused this fin to fall off the aircraft and failed first is admitted by the Boeing Company in their sworn

testimony in prior litigation, and we further submit, Your Honor, that this one aspect will be further substantiated in the depositions of these people in this litigation if there is any need to further substantiate it.

The Court: Thank you.

Gentlemen, you might check with our clerk here to be sure that all of the material, all of the depositions that have been taken have been supplied to me, and I will take this under advisement.

Mr. Pace: Your Honor, I don't know if this is the proper time to ask the court on two other motions that the plaintiff has pending before this court, and that is the motion for continuance of the trial and the motion for a commission of letters rogatory to take depositions of various people in Japan who participated in the investigation which led to the Japanese report and who were eyewitnesses to the accident and disintegration of the aircraft in the air.

The Court: Let's get this out of the way first before we consider the other matters. This matter is now set for when?

Mr. Pace: November 8, Your Honor, and we have noticed discovery, but as set forth in my affidavits for the motion for continuance, we quite honestly do not believe that it can be completed by November 8 at this stage.

The Court: How long has this been pending?

Mr. Pace: Well, Your Honor, the actions were started in New York and California in 1974, they were transferred here sometime in 1974 on a 1404 motion by counsel for Boeing in California and New York and not to go into my affidavit in any detail, but I believe that counsel for Boeing could not find much to disagree that we have not been sitting back allowing time to run, and at times we have had

serious, and, I believe, meaningful discussions amongst ourselves and also among our principals concerning a disposition of this case without further litigation, without the further costs of discovery. But that was proven at this time to be unsuccessful and we must go on with the discovery. Of course, that might not be needed if Your Honor does decide on the summary judgment motions one way or the other, but in the meantime we have moved for a commission to take the depositions of personnel in Japan.

We have produced some ten or eleven witnesses for counsel for Boeing in London during July, and we noticed depositions of Boeing people here in Seattle as well as requesting a number of documents within, I think—I think it's beginning in October, next month, but with all of that, all those scheduled to be conducted prior to the trial date, I would be rather honest and candid, I just do not estimate that I or any of the attorneys who would work on this case, including my counsel here in Seattle, could complete their discovery by November 8th trial date.

The Court: I will take those matters under advisement too, and if these summary judgments are denied, then I will respond also on the motion for continuance and also for letters of rogatory. But I will have an answer for you next week. I think all of the material is here, is it not?

Mr. Gerrard: I think so, Your Honor.

The Court: There is some that came in this morning, is there anything more?

Mr. Pace: We had not received until this morning copies of a deposition that we handed to you with the affidavit concerning the BOAC depositions. We would like to have an opportunity, Your Honor, to read that affidavit

and the depositions that were handed to you and perhaps make a response to it within the next week.

Mr. Gerrard: Your Honor, all the affidavit does is page cite to sentences within the deposition, it's the sort of thing that could be easily checked.

Mr. Pace: Your Honor, I believe I could have done it if I had had the opportunity to do it earlier this morning, but they were given to me immediately before they were given to you.

The Court: If you want to file anything, file it by next Wednesday.

Mr. Pace: Thank you.

(Court recessed subject to call.)

CERTIFICATE

I, GERALD J. POPELKA, Official Court Reporter for the United States District Court in and for the Western District of Washington, do hereby certify that the foregoing is a true and correct transcription of my stenographic notes of the proceedings had herein.

GERALD J. POPELKA
Official Court Reporter

Notice of Motion for Partial Summary Judgment

UNITED STATES DISTRICT COURT

WESTERN DISTRICT OF WASHINGTON

Nos. C74-257S and C74-380S

BRITISH OVERSEAS AIRWAYS CORPORATION,

Plaintiff,

vs.

THE BOEING COMPANY,

Defendant.

To:

PERKINS, COIE, STONE, OLSEN & WILLIAMS
1900 Washington Building
Seattle, Washington 98101

Attorneys for Defendant
The Boeing Company

PLEASE TAKE NOTICE, that upon the annexed Affidavit of Ronald E. Pace, Exhibits "1" through "48" submitted herewith and upon all pleadings and proceedings heretofore and herein, the undersigned will move this Court at a Motion Term to be held at the United States Courthouse, Seattle, Washington, on the 4th day of June, 1976, or as soon thereafter as counsel can be heard, for an Order, pursuant to Rule 56, Federal Rules of Civil Procedure, granting partial Summary Judgment in favor of plaintiff British Overseas Airways Corporation against defendant The Boeing Company on liability, on the ground that there is no genuine issue of material fact and plaintiff British

Notice of Motion for Partial Summary Judgment

Overseas Airways Corporation is entitled to partial Summary Judgment on liability as a matter of law.

British Overseas Airways Corporation respectfully requests that the Court grant oral argument of the within Motion in the belief that oral argument will be of assistance to the Court on the resolution of the within Motion, and respectfully requests 15 minutes for oral argument.

Yours,

BOGLE & GATES

By /s/ WILLIAM L. PARKER, ESQ.
William L. Parker, Esq.
The Bank of California Center
Seattle, Washington 98164

and

CONDON & FORSYTH

By /s/ RONALD E. PACE, ESQ.
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Affidavit in Support of Motion for Summary Judgment

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BRITISH OVERSEAS AIRWAYS CORPORATION

UNITED STATES DISTRICT COURT

WESTERN DISTRICT OF WASHINGTON

Civil Action No. C74-257S
Civil Action No. C74-380S

BRITISH OVERSEAS AIRWAYS CORPORATION,

Plaintiff,

vs.

THE BOEING COMPANY,

Defendant.

State of New York,
County of New York—ss.:

RONALD E. PACE, being first duly sworn, deposes and says:

Affidavit in Support of Motion for Summary Judgment

1. I am an attorney and counsellor at law associated with the firm of Condon & Forsyth, attorneys for plaintiff British Overseas Airways Corporation (hereinafter BOAC). I have participated in the prosecution of these actions since their inception and I am fully familiar with all prior proceedings heretofore had herein.

2. I submit this Affidavit in Support of the within Moton of BOAC, pursuant to Rule 56, Federal Rules of Civil Procedure, for an Order granting partial Summary Judgment in favor of BOAC against Boeing on liability, on the ground that there is no genuine issue as to any material fact with respect to liability and plaintiff BOAC is therefore entitled to partial Summary Judgment as a matter of law.

3. These are actions by plaintiff BOAC against defendant Boeing for the loss and destruction of a certain Boeing 707-436 aircraft, registration G-APFE, designed and manufactured by Boeing and sold to BOAC in 1960, which broke up in flight near Tokyo, Japan on March 5, 1966. These actions are also to recover for consequential losses sustained by BOAC resulting from the loss and destruction of its aircraft.

4. The actions were commenced by the filing of Complaints in the United States District Courts for the Southern District of New York and for the Central District of California.

BOAC's Complaints contain causes of action based upon negligence, breach of express and implied warranties, misrepresentation, as well as strict liability for defective design and manufacture of products. Copies of BOAC's Complaints are submitted herewith as Exhibit "1".

Defendant Boeing's Answer admits having designed and manufactured the subject aircraft, but denies allegations of defective design and manufacture, negligence and breach of warranties. A copy of defendant Boeing's Answer is submitted herewith as Exhibit "2".

On Motion of defendant Boeing, these actions were transferred to the United States District Court for the Western District of Washington pursuant to 28 USC §1404(a).

5. As appears more fully from BOAC's Memorandum of Reasons and Authorities and from the Exhibits that are submitted herewith, Boeing *has admitted* the following material facts:

a) The subject aircraft, G-APFE, was designed and manufactured by Boeing and was sold to BOAC in 1960;

b) On March 5, 1966, while the subject aircraft was in flight near Tokyo, Japan, the vertical fin of the subject aircraft failed at its attachment fittings and fuselage bulkhead and separated from the aircraft in flight, resulting in the crash of the aircraft causing the deaths of all passengers and the destruction of the aircraft;

c) The fatigue fractures of the vertical fin existed prior to the day of the crash and were caused because the fittings and bulkhead of the vertical fin were defectively designed and manufactured by Boeing and routinely failed during normal use.

6. Boeing has admitted the above material facts by and through its employees who investigated and are familiar with the facts surrounding the crash of G-APFE and of

the design and manufacture of the vertical fin and supporting structures of the 707 aircraft. These employees include, *inter alia,* Boeing's Accident Investigation Coordinator, Boeing's Service Department Chief, Boeing's Structures Technology Chief, and Boeing's Director of Program Management for the 707. These material facts are also admitted in the records and investigations of the accident conducted by The Boeing Company which were made and maintained in the usual course of business.

7. As also appears more fully from BOAC's Memorandum of Reasons and Authorities, since Boeing has admitted having defectively designed and manufactured the vertical fin and supporting structures of the subject aircraft and has also admitted that this defect caused the crash of the subject aircraft, BOAC is entitled to judgment as a matter of law under the law of Washington with respect to strict liability for defective design and manufacture of products.

WHEREFORE, it is respectfully requested that the Court enter an Order herein, pursuant to Rule 56, Federal Rules of Civil Procedure granting partial Summary Judgment in favor of plaintiff British Overseas Airways Corporation against defendant The Boeing Company on the issue of liablity.

/s/ RONALD E. PACE
Ronald E. Pace

Sworn to before me this
day of May, 1976

/s/ RAYMOND W. BELAIR
Notary Public

Memorandum in Support of Motion for Partial Summary Judgment

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UNITED STATES DISTRICT COURT

WESTERN DISTRICT OF WASHINGTON

Nos. C74-257S and C74-380S

BRITISH OVERSEAS AIRWAYS CORPORATION,

Plaintiff,

vs.

THE BOEING COMPANY,

Defendant.

PRELIMINARY STATEMENT

These are actions by plaintiff British Overseas Airways Corporation (hereinafter BOAC) against defendant The

Memorandum in Support of Motion for Partial Summary Judgment

Boeing Company (hereinafter Boeing) for the loss and destruction of a certain Boeing 707-436 aircraft, registration, G-APFE, designed and manufactured by Boeing and sold to BOAC, which disintegrated in flight near Tokyo, Japan on March 5, 1966, as well as for consequential damages flowing from said loss and destruction.

THE PLEADINGS

These actions were commenced by the filing of Complaints in the United States District Courts for the Southern District of New York and for the Central District of California.

BOAC's Complaints contain causes of action based upon negligence, breach of express and implied warranties, misrepresentation, as well as strict liability for defective design and manufacture of products. Copies of BOAC's Complaints are submitted herewith as Exhibit "1".

Defendant Boeing's Answer admits having designed and manufactured the subject aircraft, but denies allegations of defective design and manufacture, negligence and breach of warranties. A copy of defendant Boeing's Answer is submitted herewith as Exhibit "2".

On Motion of defendant Boeing, these actions were transferred to the United States District Court for the Western District of Washington pursuant to 28 U.S.C. §1404(a).

THE MOTION

Plaintiff BOAC now moves this Court for an Order, pursuant to Rule 56, Federal Rules of Civil Procedure, granting partial Summary Judgment on the issue of liability in favor of plaintiff BOAC against defendant Boeing on the ground that there is no genuine issue as to any material

fact and plaintiff BOAC is therefore entitled to judgment as a matter of law.

Specifically, it is submitted that there is no genuine issue as to the following material facts:

1. Boeing designed and manufactured the subject aircraft which was sold to plaintiff BOAC in 1960;

2. The subject aircraft was defective in both design and manufacture at the time it was sold to BOAC;

3. The defective design and manufacture caused the vertical tail fin of the aircraft to separate from the aircraft in flight, resulting in the crash in which all persons perished and in which the aircraft was destroyed.

Plaintiff BOAC does not dispute the position of Boeing that the cause of the subject aircraft crash was that fractures in the vertical fin fittings and bulkhead caused the fin to separate from the aircraft in flight and that the fractures were caused by defective design and defective manufacture of the aircraft's fin terminal fittings and bulkhead. Rather, it is on this basis that BOAC now moves this Court for partial Summary Judgment for the reason that there is no genuine issue of material fact herein.

The position of Boeing concerning the cause of this crash is set forth, *inter alia,* in Boeing's Answers to Interrogatories, Depositions and Boeing's internal investigations and reports which were made and maintained in the regular and usual course of business, which were produced and identified at deposition.

Since there may be, *arguendo,* genuine issues of material fact concerning the quantum of plaintiff BOAC's damages, BOAC now moves for partial Summary Judgment on the issue of liability only.

INTRODUCTION

On March 5, 1966 a Boeing 707-436 aircraft, registration G-APFE and operated by BOAC as regularly scheduled passenger flight BA 911, departed from Tokyo, Japan, bound for the British Crown Colony of Hong Kong. Shortly after takeoff, while the aircraft was being operated in straight and level flight at an altitude of approximately 12,000-17,000 feet, the vertical tail fin of the aircraft fractured and failed at its terminal fittings and from its fuselage bulkhead, separating from the aircraft, making further flight impossible. The aircraft plummeted immediately to earth, further disintegrating as it fell. All persons perished and the aircraft was destroyed.

After the accident, investigation consisting principally of the findings of Boeing which were made in the regular and usual course of business, revealed the following:

1. The subject aircraft was designed, manufactured and sold by Boeing to BOAC in 1960 [Boeing's Answers to Interrogatories (Exhibit "3"), Nos. "9" and "10"].

2. The subject aircraft, known as G-APFE, and many other Boeing 707 aircraft were defectively designed and manufactured with attachment fittings (used to attach the aircraft's entire vertical fin to the aircraft) and fuselage bulkhead which had fractured and failed, causing the fin to separate from the aircraft in flight. The fittings and bulkhead were defectively designed and manufactured by Boeing and routinely failed during normal use.

3. Boeing's post accident investigation of the subject aircraft crash revealed that fractures were found in (1) the fuselage bulkhead where the vertical fin is attached

to the body of the aircraft, (2) the vertical fin fittings which attach the fin to the fuselage and (3) the bolts used to join the fittings of the fin and the fuselage.

4. Boeing's post accident investigation also revealed that the fractures in the bolt holes were in an area of "untempered martensite". According to Boeing, untempered martensite is a defect of weakened steel which occurred during manufacture when a (here, bolt) hole is drilled with a dull drill bit or at an improper drill speed.

5. Boeing was aware, more than five years prior to the crash of the subject aircraft, that defects, fractures, and corrosion were being located in the area of the vertical fin of various 707 aircraft; Boeing, through its Field Representative, as well as its Service Department in Renton, Washington did not correct this problem.

6. Boeing was aware, as early as four years prior to this accident that the vertical fin body terminal fittings of the *subject* aircraft had developed defects, fractures and corrosion; Boeing through its Field Representative, as well as its Service Department in Renton, Washington, did not correct this problem.

7. According to Boeing's representations, a 707-436 aircraft, as is here instant, should, with proper maintenance and inspection, have a useful life of no less than 20 years or 50,000 to 60,000 flight hours. Similarly, all fittings, attachments and other components of the aircraft's vertical fin and fuselage should have a useful life of no less than 20 years or 50,000 to 60,000 flight hours. With on-site inspection and purportedly informed recommenda-

tions by Boeing representatives, in conjunction with its Service Department in Renton, Washington, the subject aircraft disintegrated in flight less than 6 years and less than 20,000 flight hours after delivery to BOAC.

8. The subject aircraft disintegrated while being operated in straight and level flight, in accordance with applicable law, within specifications established by Boeing as proper, in fair weather with unlimited visibility and under conditions which, according to Boeing, were neither unique nor unusual.

Moreover, it is the position of BOAC that this Court will find of particular relevance and aid in the resolution of the within motion, the facts, circumstances and litigation surrounding the crash of a United States Air Force Boeing KC-135 (the military version of the 707) which took place near Mt. Lassen, California on July 30, 1968. Much of the testimony in that litigation pertains to the Boeing 707 generally, as well as to the G-APFE aircraft, which is the subject of this action, and to its crash.[1] According to Boeing, the KC-135 crash resulted, as here, when the vertical fin of the aircraft separated from the fuselage of the aircraft during flight as a result of fracture and failure of the aircraft's vertical fin fittings and bulkhead.

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[1] Multiple depositions of Boeing personnel were taken in both the passenger litigation arising from the subject crash as well as in litigation arising from the crash of the United States Air Force Boeing KC-135. Unless otherwise indicated, all references to depositions herein relate to the passenger litigation which arose out of the subject crash. All depositions arising out of the litigation surrounding the crash of the United States Air Force Boeing KC-135 are denoted by the suffix "(KC-135)".

Point I

The Vertical Fin of the Subject Aircraft Separated From the Aircraft in Flight

The attention of this Court is respectfully invited to attached Exhibit "4" which is a two-page diagram depicting port and starboard views of the vertical fin and tail section of the subject BOAC aircraft, G-APFE. The Court's attention is particularly invited to Page 2 of Exhibit "4" which depicts the starboard view, and to the area in the bottom center of the vertical fin where it meets the fuselage of the aircraft at Station 1505, which is outlined in red on Page 2. In this area are located both the vertical fin fittings which hold the fin to the bulkhead [which fractured prior to the accident, according to Boeing] and the bulkhead of the fuselage [which fractured at Station 1505] both of which failed at Station 1505 during flight, according to Boeing, causing the entire vertical fin to separate from the aircraft in flight. This is the area of the subject aircraft which is of direct concern on the within motion, for the reason that the separation of the vertical fin from the aircraft initiated at the fitting and bulkhead at Station 1505.

Boeing has established that the vertical fin of the subject aircraft separated from the aircraft in flight [Boeing's Answers to Interrogatories (Exhibit "3"), No. "27"; Hansen[2] Deposition (Exhibit "5") (Vol. I) p. 94:7-16; Morgan[3] Deposition (Exhibit "6") p. 71:20-24].

[2] At all relevant times Walter J. Hansen was Boeing's Service Engineer.

[3] At all relevant times Richard M. Morgan was Boeing's Service Department Chief.

"Q. Do you agree that on the date of this accident that the empennage [vertical fin] of this plane did separate from the fuselage while the plane was in flight?

A. From the wreckage distribution, which I saw, the empennage portions did separate from the fuselage in flight.

Q. And in that process, the vertical fin went back and struck the left horizontal stabilizer?

A. In the process of separation, the vertical fin came into contact with the left horizontal stabilizer." Hansen Deposition (Vol. I) p. 94:7-16.

"Q. As of May 10, 1966, the date of this conversation, you were satisfied that the vertical fin on this particular airplane of BOAC, No. G-APFE, had come off in flight?

A. Yes." Morgan Deposition p. 71:20-24.

Boeing also learned during its participation in the investigation of the accident and the assistance which it rendered to the Japanese Civil Aeronautics Board in its investigation of the crash, that the tail of the aircraft separated from the aircraft before any other part of the aircraft [Hogue[4] Deposition (Exhibit "7") p. 34 : 2-11; Japanese Civil Aeronautics Board Report (Exhibit "8") p. 16]. Boeing has accepted and agrees with the official Japanese Civil Aeronautics Board Report with respect to this accident [Smith[5] Deposition (Exhibit "9") p. 6:5-8]:

[4] At all relevant times H. Prater Hogue was Boeing's Accident Investigation Coordinator.

[5] At all relevant times Howard W. Smith was Boeing's Director of Program Management for the 707-720 Division.

"1.12 Aircraft Wreckage

• • • • •

b) Distribution of the Wreckage

The above aircraft parts and other fragments were scattered over an area approximately 16 kilometres long from east to west and approximately 2 kilometres wide. [Reference omitted]

The main wreckage consisting of starboard and port wings and mid-aft fuselage was found on the ground heading in a westerly direction; its condition was such as to support a presumption that immediately before impact it fell almost vertically in a nearly level attitude.

No. 1 to No. 4 engines and their pylons fell in an area 0.5 to 2 kilometres to the west of the main wreckage. The forward fuselage (including cockpit) was found 0.3 kilometres to the west of the main wreckage.

The starboard wing section (including part of No. 4 pylon) between the vicinity of STA 500 and STA 733 was found in an area 1 to 2 kilometres to the east of the main wreckage. In an area 2 to 3 kilometres to the east of the main wreckage were found the starboard section of STA 733), starboard horizontal stabilizer (including centre section), starboard elevator, rear spar of the port horizontal stabilizer, a part of the port elevator, the rear spar and trailing edge section of the vertical stabilizer and the upper half of the rudder. In an area *3 to 4 kilometres* to the east of the main wreckage were found fragments of the *vertical stabilizer, port horizontal stabilizer, rudder, elevators, tabs,*

starboard wing skin, tail cone and ventral fin. In an area *4 to 6 kilometres* to the east of the main wreckage were found fragments of the *horizontal stabilizer, vertical stabilizer,* rudder and cabin bulkheads". Exhibit "8". p. 11-12 (Emphasis added)

"1.15 Tests and Research

• • • • •

c) *Trajectory of Aircraft Parts*

Based on the wreckage distribution chart and the estimated wind velocity at the time of the accident, and also the results of air drag experiments using models, *the trajectory of representative aircraft parts was analyzed and an estimation made of where they broke away in the air with the following results:*

No time difference was apparent between the breakup of the right wing at STA 733 and the area around STA 550; they broke away above the main wreckage impact area.

The engine pylons and the forward fuselage broke up almost at the same time and they broke away above the main wreckage impact area.

The vertical stabilizer and the port horizontal stabiliber broke away almost at the same time above a location a little to the east of the main wreckage impact area.

It was not possible to determine the sequence of breakup of the starboard outer wing, the engine pylons and the forward fuselage.

The vertical stabilizer [fin] and the port horizontal stabilizer broke away somewhat earlier than the starboard outer wing, engine pylons and the forward fuselage".

Exhibit "8", p. 16 (Emphasis added)

Boeing has accepted and agrees with these findings.

"Q. Did Boeing accept and agree with the official Japanese report that came out of this particular accident?

A. We found nothing of substance in there to disagree with that I'm aware of".

Smith Deposition (Exhibit "9") p. 6:5-8.

This is consistent with the Aircraft Accident Report of the Japanese Civil Aeronautics Board (Exhibit "8") pp. 11-12 and is also supported by the Wreckage Distribution Chart (Exhibit "10"), identified by Boeing's Service Engineer, Walter J. Hansen [Hansen Deposition (Exhibit "5") (Vol. II) p. 21:25—p. 22:22], which shows the vertical fin as the major piece of the aircraft located farthest from the area of the main wreckage site. Further corroboration of this point is supplied by photographs of the wreckage [Japanese Civil Aeronautics Board Report (Exhibit "8") p. 11]. One such photograph (Exhibit "11") shows the vertical fin located farthest (to the north) from the main wreckage (background of Exhibit "11"), establishing that it separated first from the aircraft [Hansen Deposition (Exhibit "5") (Vol. 1) p. 62:22—p. 63:1, (Vol. II) p. 15:23—p. 16:21, p. 23:24—p. 24:13]. The vertical fin is followed by the horizontal stabilizer (foreground of Exhibit "11")

found next closest to the main wreckage [Hansen Deposition (Exhibit "5") (Vol. 1) p. 63:4-5].

The Court's attention is once again respectfully invited to Exhibit "4" from which it clearly appears that, with the aircraft fully intact, the horizontal stabilizer is located directly below and adjacent to the vertical fin and bulkhead Station 1505 where the fin joins the fuselage, just above the legend: "Tail Cone". Boeing has admitted that the vertical fin failed, separated from the aircraft and struck the left horizontal stabilizer [Hansen Deposition (Exhibit "5") Vol. I) p. 94:7—p. 95:10; (Vol. II) p. 31:10—p. 32:11; Hogue Deposition (Exhibit "7") p. 22:10-18; Japanese Civil Aeronautics Board Report (Exhibit "8") pp. 13, 21]. This is confirmed by Exhibit "11" which shows the vertical fin and the horizontal stabilizer as the large pieces of the aircraft farthest, respectively, from the main wreckage area in a northerly direction from which the aircraft was travelling [Hansen Deposition (Exhibit "5") (Vol. I) p. 29:2-8]. The vertical fin was found five to seven miles from the main wreckage [Zahn[6] Deposition (Exhibit "12") p. 62:1-22].

All wreckage was found in the location where it had fallen and had not been moved [Zahn Deposition (Exhibit "12") p. 9:3-8]. The entire wreckage covered seven to ten miles. [Hansen Deposition (Exhibit "5") (Vol. 1) p. 16:10-12].

Other evidence that the vertical fin separated first from the aircraft is the Trajectory Analysis prepared by Boeing (Exhibit "13") which shows the vertical fin (circled at Station "16" of the diagram) as the major piece of the

[6] At all relevant times Harold R. Zahn was Boeing's Group Supervisor/Lead Engineer in the Metallurgical Technological Unit.

aircraft located farthest from the main wreckage. This was prepared by Mr. Hopkins, a Boeing areodynamist. [Hansen Deposition (Exhibit "5") (Vol. II) p. 11:1—p. 12:4].

"Q. Could you explain what these curved lines and so forth reveal?

A. Well, this is a trajectory analysis. The lines on the chart are an attempt at showing how various parts that had sizes and weight would have been expected to fall through the air under given wind conditions which are either assumed or known. The basic attempt is to determine where various parts could have separated from the aircraft."
Hansen Deposition (Exhibit "5") (Vol. II) p. 11:22—p. 12:4 (Emphasis added)

"Q. My question, though, was: What was there between the fin and Gotemba [closer to main wreckage site] that was of the comparable size and density and weight of this fin?

A. Very—nothing that I can think of. . . ."
Hansen Deposition (Exhibit "5") (Vol. I) p. 62:22-25.

Graphic evidence showing that the vertical fin first separated from G-APFE is a photograph of the aircraft taken from the ground prior to impact (Exhibit "14"). The photograph, identified during the deposition of Mrs. G. J. Ashcroft, secretary to B. F. Folliard, BOAC's Chief Accident Investigator, in the litigation arising from the deaths of the passengers, depicts a view from below and to the left and rear of the falling aircraft. The photograph was taken

by a ground witness. The photograph clearly shows the wings still attached to the aircraft. The vertical fin is conspicuously missing. The darkened area in the center of the photograph shows the fuselage with the tail and vertical fin missing.

There is further corroborative, although now cumulative, testimony from Boeing showing that the vertical fin of G-APFE first separated, bearing in mind that the wing separated subsequent to the vertical fin.

"Q. What would have happened to a 707 in flight if the outboard of the right wing failed first?

A. This is again out of my field but we have had aircraft who [sic] have lost that section of the wing and have landed.

Q. In that area where the outboard engine caught on fire and the whole wing, I mean, that whole portion of that outboard wing, the plane has still been able to land; right?

A. I have personally observed airplanes after that has occurred".
Hansen Deposition (Exhibit "5") (Vol. II) p. 33:17—p. 34:1

Compare, however, Boeing's statement in the situation where the vertical fin first separated from the aircraft:

"Q. The [fin body] terminal fitting is a critical part of the [707] aircraft, is it not?

[Objection as to form omitted]

Q. Isn't it a critical part that, if it fails, it can lead to catastrophic failure of the aircraft?

A. Yes.

Q. The terminal fitting on the KC-135 and the 707 is a critical part, isn't it?

A. Yes.

Q. And a crack in a critical part such as a terminal fitting can lead to catastrophic failure of the aircraft, isn't that correct?

A. If not found and properly removed, it would result in complete failure".

Morgan Deposition (KC-135) (Exhibit "15") p. 49:20—p. 50:10 (Emphasis added).

Point II

THE VERTICAL FIN SEPARATED FROM THE AIRCRAFT BECAUSE THE FIN FAILED AND FRACTURED AT THE FUSELAGE BULKHEAD AT THE RIGHT HAND FIN BODY TERMINAL FITTING. THE FITTING FRACTURE BEGAN AT A FATIGUE FRACTURE IN THE HOLES OF THE FITTING WHICH PRE-EXISTED THE ACCIDENT.

Boeing has established and adopted as one of its "official conclusions" that the final fracture of the right hand fin body terminal fitting of G-APFE initiated at a fatigue fracture which existed prior to the subject crash in hole R-1 of the fitting [Zahn Deposition (Exhibit "12") p. 53:16, p. 54:18; Hogue Deposition (Exhibit "7") p. 20:6-26, p. 45:8-23; Larsen[7] Deposition (Exhibit "16") (Vol. I) p. 47:1, p. 49:1; Morgan Deposition (Exhibit "15") (KC-135) p. 213:4-13; Ramsey[8] Deposition (Exhibit "17")

[7] At all relevant times Alvin C. Larsen was Boeing's Structures Technology Chief.

[8] At all relevant times James A. Ramsey was Boeing's Customer Engineer/Research Engineer (Metals and Standards Group).

p. 12:1-4 , p. 34:22-26, p. 66:19-20], and that the right rear fin terminal attachment fitting contained areas of untempered martensite which were also found in the bores of holes R-3 and R-29 of the fitting from which the cracks originated. [Hogue Deposition (Exhibit "7") p. 20:6-26, p. 45:8-23; Larsen Deposition (Exhibit "16") (Vol. II) p. 14:6-12, Ramsey Deposition (Exhibit "17") p. 99:4-6, p. 100:1, p. 109:21, p. 112:1-14].

"Q. As I understand it now when you say you found this part to have what you call a potential fatigue and you wanted it studied and [Boeing Metallurgical Examination of Fin Body Terminal From BOAC A/P G-APFE, No. T6-3577 dated April 14, 1966] represents the results of that study—

A. Correct.

Q. Which confirmed your suspicions that this was a pre-existing fatigue—Correct?

A. Yes.

Q. —that was in the airplane sometime, this is what, this means that this was in existence in the plane sometime prior to the actual accident?

A. Correct".

Zahn Deposition (Exhibit "12") p. 54:6-18

"Q. Do you see stated on that sheet (Exhibit "18) that I called your attention to, a Boeing Conclusion that the final fracture of the right-hand fin body terminal fitting initiated in an existing crack in hole R-1?

A. I see that as No. 1, yes.

Q. Do you see the further conclusion that the existing crack was a fatigue crack?
A. I see that as No. 2, yes.

Q. Do you further see the conclusion that this right rear fin terminal attach[ment] fitting had untempered martensite areas in it?
A. No. 5 refers to untempered martensite was [sic] observed in the bores of hole R3 and R29.

Q. These are official Boeing conclusions, are they not?
A. To the best of my knowledge they are, yes.

Q. That means, does it not, that that right rear fin terminal attach[ment] fitting was defective when Boeing manufactured it?

[Witness instructed by counsel not to answer]" Hogue Deposition (Exhibit "7") p. 45:8—p. 46:3

"Q. Do you notice on that exhibit (Exhibit "18") that on the face of it it said it was prepared by J.A. Ramsey?
A. Yes.

Q. And supervised by R.A. Davis?
A. Yeah.

Q. Then it says 'Approved by A.C. Larsen'?
A. Yes.

Q. Is that you?
A. Yes.

Q. And that is your signature?
A. Yes.

Q. So you did approve this report?
A. Yes.

Q. That means you agreed with it?
A. Yes.

• • • • •

Q. And I notice it says that the final fracture of this right-hand terminal fitting began, initiated at an existing crack in hole R-1; do you see that?
A. Yes.

Q. That means the existing crack was there before the actual accident?
A. Yes.

Q. Pre-existed the accident?
A. Yes.

Q. It said that the existing crack, which you agree pre-existed the accident, was a fatigue crack?
A. Yes."

Larsen Deposition (Exhibit "16") (Vol. 1) p. 47:10—p. 49:1

"Q. Were you in charge of all that work [Metallurgical Examination]?
A. Well, in charge of the rather—I had this particular job assigned to me, and the various different tests—I did not witness all the tests, for instance, but the data came to me to put in the report.

Q. Who assigned you this task?
A. My immediate supervisor.
Q. What is his name?
A. It was Robert Davis . . .

• • • • •

Q. As I understand it, on this [Metallurgical Examination (Exhibit "18")] one of your findings was that there were existing fatigue cracks in a hole initiating from what you designated as hole R-1; is that right?

A. Yes, sir."

Ramsey Deposition (Exhibit "17") p. 11; 2—p. 12:4

"Q. I notice that you said that that bolt showed a classic fatigue crack?

A. Yes, sir.

Q. What do you mean by 'classic fatigue crack'?

A. It showed, in our opinion, the growth rings of a progressing crack due to cyclic loading.

Q. What kind of loading is cyclic loading?

A. A repeated load of most any magnitude that you would—

Q. That would have existed prior to the actual fact of the accident, the final failure?

A. It would have existed prior to final failure, yes".

Ramsey Deposition (Exhibit "17") p. 36:26—p. 37:12

These conclusions and others are contained in Boeing's *Metallurgical Examination of Fin—Body Terminal From BOAC A/P G-APFE, No. T6-3577* (Exhibit "18") dated April 14, 1966 in which are detailed the conclusions reached as a result of tests performed on fin fittings of G-APFE. The Report was prepared by James A. Ramsey, Boeing's Customer Engineer/Research Engineer (Metals and Standards Group) and approved by Alvin C. Larsen,

Boeing's structures Technology Chief. [Larsen Deposition (Exhibit "16") (Vol. I) p. 47, l. 4-24]. The conclusions reached in the Report were as follows:

"3.

CONCLUSIONS

1. Final fracture of the R.H. fin body terminal fitting initiated at an existing crack in hole R-1.
2. The existing crack in hole R-1 was a fatigue crack.
3. Final fracture was a ductile tensile fracture.
4. A load substantially larger than those causing fatigue growth was experienced by the fitting.
5. Untempered martensite was observed in the bores of hole R-3 and R-29.
6. Material chemistry and mechanical properties met the applicable specification requirements.
7. The bolt in hole R-1 had an existing fatigue crack." Exhibit "18", p. 13.

The Report further found that the right hand fin terminal fitting had fractured in a nearly vertical load application, that the fracture had initiated in hole R-1 by fatigue and had progressed to hole R-4 and was a fatigue fracture. [Morgan Deposition (KC-135) (Exhibit "15") p. 212:5-16].

Mr. Ramsey also testified that the fracture in hole R-3 of the fin terminal attachment fitting was located immediately below hole R-1 [Ramsey Deposition (Exhibit "17") p. 65, l. 12-21]. These findings were confirmed by the

Japanese Civil Aeronautics Board in their Aircraft Accident Report (Exhibit "8") pp. 12-13, 16-17.

These fractures of the fin had progressed by fatigue. [Morgan Deposition (KC-135) (Exhibit "17") p. 64:6-19].

The only structural defect found by the Japanese Civil Aeronautics Board in their Report was the fractures of the fin fitting (Exhibit "8", p. 13).

It was, in fact, the finding that the fractures in the fin terminal fitting existed prior to disintegration of the aircraft which prompted Boeing to issue Alert Service Bulletin 2422 (Exhibit "19") (calling for inspection by all air carriers of their vertical fin fittings) less than a month after the crash [Hogue Deposition (Exhibit "7") p. 16:1-26; Morgan Deposition (KC-135) (Exhibit "15") p. 128:22—p. 129:3].

> "Q. The [post G-APFE crash] Service Bulletin regarding the stronger fitting, did it have a time compliance provision in it?
>
> [Objection as to form omitted]
>
> A. I don't remember.
>
> Q. However, you, as Chief of the Service Department, felt, did you not, that unless the Service Bulletin was followed and the stronger fittings and surrounding attachments were placed on the 707, *that other fittings may fail and airplanes may crash, didn't you?*
>
> [Objection as to form omitted]
>
> A. Yes."

> Morgan Deposition (KC-135) (Exhibit "15") p. 128:17—p. 129:3 (Emphasis added)

H. Prater Hogue, Boeing's Accident Investigation Coordinator, testified in this respect:

> "The Reporter: 'An existing fatigue crack in one of the terminal fittings of the 707 and the KC-135 would be a defect, would it not?'
>
> A. Yes."
>
> Hogue Deposition (KC-135) (Exhibit "20") p. 30, l. 21-24

The foregoing findings were confirmed by Boeing metallurgist Harold R. Zahn who was the Lead Engineer/Group Supervisor of the Boeing Metallurgical Technological Unit at all relevant times [Zahn Deposition (Exhibit "12") p. 4:15-24; Hogue Deposition (Exhibit "7") p. 6:18-21] as well as by Mr. Jones of Boeing's Service Department, and approved by H. Prater Hogue as Boeing's official conclusions [Hogue Deposition (Exhibit "7") p. 20:23-26, p. 45:8-23].

A telex (Exhibit "21") from Mr. Hogue to Boeing's Field Representative Vogwill shortly after the G-APFE crash, on May 27, 1966 [Hogue Deposition (Exhibit "7") p. 61:14—p. 64:6]; Boeing Telex (Exhibit "21") acknowledges that the martensite was formed during preparation of the hole [Hogue Deposition (Exhibit "7") p. 63:18—p. 64:6; Larsen Deposition (Exhibit "16") (Vol. II) p. 21:15-24; Exhibit "21"] as well as Mr. Zahn's other findings confirmed in Exhibit "18".

All of the findings were adopted by Boeing, and by its Accident Investigation Coordinator Mr. Hogue, as Boeing's

true and accurate conclusions concerning this crash [Hogue Deposition (Exhibit "7") p. 20:11-14, p. 23-26, p. 45:8-23].

Mr. Zahn had visually observed that the bolt for hole R-1 was found broken, completely fractured at the root of the threads [Zahn Deposition (Exhibit "12") p. 48:3-12] which is also confirmed by Mr. Larsen [Larsen Deposition (Exhibit "16") (Vol. I) p. 55:25-26] and Mr. Ramsey Deposition (Exhibit "17") p. 35:10—p. 36:25] who stated that this fracture existed prior to the accident [Ramsey Deposition (Exhibit "17") p. 37:9-12]. Larsen acknowledged that this occurred despite proper maintenance by BOAC [Larsen Deposition (Exhibit "16") (Vol. I) p. 56:18-25].

Zahn also found the terminal end of the left hand fitting of the fin attachment bulkhead fractured at station 1505 [Zahn Deposition (Exhibit "12") p. 52:22—p. 53:3; Metallurgical Report (Exhibit "18") p. 14].

Untempered martensite was also found in bolt hole R-29 [Ramsey Deposition (Exhibit "17") p. 77:1-19] and bolt hole R-3. These are official Boeing conclusions [Hogue Deposition (Exhibit "7") p. 45:8-23].

Significantly, these holes would be drilled by Boeing or its subcontractors sometime during manufacture of the aircraft before delivery to BOAC. [Hogue Deposition (Exhibit "7") p. 64:16-25; Larsen Deposition (Exhibit "16") (Vol. II) p. 21:11—p. 22:5; Ramsey Deposition (Exhibit "17") p. 18:5-23, p. 85:3-11].

Untempered martensite is a defect of weakened steel which is caused by the use of a dull drill bit or improper drill speed [Morgan Deposition (Exhibit "6") p. 65:25—p. 66:5; Morgan Deposition (KC-135) (Exhibit "15") p. 96:22—p. 97:7].

It is of further significance that Boeing, through its BOAC field Representative Ian Vogwill, in a letter (Exhibit "23") to Mr. Folliard, BOAC's Chief Inspector of Accidents, states that corrosion inhibiting compound was *not* used in the assembly of 707 aircraft at any time *prior* to the subject accident and that untempered martensite shows that the fitting of the subject aircraft was improperly manufactured during preparation of the bolt hole by mechanical means [Ramsey Deposition (Exhibit "17") p. 82:7—p. 84:26]. It is concluded, therefore that the defect of weakened steel existed in the aircraft as originally manufactured and delivered to BOAC by Boeing [Ramsey Deposition (Exhibit "17") p. 85:3-11; Exhibit "23"]. Mr. Vogwill received this information which he passed on to Mr. Folliard, from Mr. Hogue [Hogue Deposition (Exhibit "7") pp. 61:12—p. 65:3; (Exhibit "23")] which is accepted by Mr. Hogue as accurate [Hogue Deposition (Exhibit "7") p. 20:11-14].

"Q. Would that mean, then that this untempered martensite was in the airplane as originally manufactured and delivered from Boeing to BOAC?

A. Yes, sir, unless there'd been some rework subsequent to delivery.

Q. Did you see any evidence on that right hand fitting to indicate that that fitting had been reworked?

A. No, sir."

Ramsey Deposition (Exhibit "17") p. 85:3-11

However, Boeing took no steps to test for the presence of untempered martensite in terminal fittings after holes

had been drilled [Larsen Deposition (Exhibit "16") (Vol. II) p. 9:1-7, p. 10:26—p. 11:3]. This is so despite the fact that Boeing had been aware of martensite and its causes and the need to avoid it for *16 years prior* to the subject crash [Larsen Deposition (Exhibit "16") (Vol. II) p. 11: 21—p. 12:4; Ramsey Deposition (Exhibit "17") p. 71:2-19].

In fact, Boeing concluded after visual inspection of the subject right hand fin bolt terminal fitting at Station 1505 bulkhead *on the slopes of Mount Fuji,* just days after the crash, that the fatigue fractures existed [Zahn Deposition (Exhibit "12") p. 28:8-18] A corrosion pit was also found in hole R-1 [Ramsey Deposition (Exhibit "17") p. 63:4-10].

The subject fitting was shipped to Boeing in Washington for detailed metallurgical examination and fracture analysis. The results of the examination are contained in Boeing *Metallurgical Examination of Fin Body Terminal From BOAC A/P G-APFE, No. T6-3577* (Exhibit "18").

Mr. Zahn, who concurred in the findings in Boeing's Metallurgical Report, and who visually observed them on the slopes of Mount Fuji, also observed fatigue fractures of several other find body terminal fittings from other 707 aircraft in the four months following the accident, all of which had fatigue fractures of the bolt holes of the fin terminal fittings [Zahn Deposition (Exhibit "12") p. 34: 15—p. 35:21].

Point III

BOEING HAS DETERMINED THAT THE CAUSE OF THE SUBJECT CRASH WAS THAT THE VERTICAL FIN WAS DEFECTIVELY DESIGNED AND FAILED UNDER NORMAL USE. BOEING ALSO ADMITS THAT IT BREACHED ITS EXPRESS WARRANTIES AND MISREPRESENTED ITS PRODUCT TO BOAC.

Since Boeing has determined, and judicially admitted, that the cause of the failure of G-APFE's vertical fin fittings and the bulkhead of the fuselage to which the fin attaches was that both were defectively designed, unsuitable to carry normal loads and failed under a normal load, there is no genuine issue of material fact herein and the within motion for partial Summary Judgment should be granted. BOAC agrees with Boeing that the crash was caused by the defectively designed and manufactured vertical fin, body terminal fitting and bulkhead.

Boeing, through Alvin Larsen, its Structures Technology Chief; Richard Morgan, its Service Department Chief and Harold Hayden of its Structures Group, determined that the reason the fin terminal fittings on its 707 fleet, which includes the subject aircraft, fractured, causing the vertical fin to separate from the aircraft in flight, was that the fittings and bulkhead were defectively designed by Boeing and were not capable of carrying loads placed on them during normal flight [Morgan Deposition (KC-135) (Exhibit "15") p. 62:24, p. 63:1, p. 81:14, p. 82:17] and that the purpose of the fitting is to hold the vertical fin on the aircraft [Morgan Deposition (KC-135) (Exhibit "15") p. 63:10-12].

> "The Reporter: 'Usage of the 707 and KC-135 revealed that the terminal fitting and the surrounding struc-

tures were not designed strong enough to carry the loads that they experienced during flight, isn't that correct?

[Objection as to form omitted]

A. We found that this particular structure in *normal flight under normal operation, under normal loads, cracked* and as near as I can remember, that's as far as it went, cracks therein. *We are talking about normal performance, normal operation.*

Q. And standard and accepted design parts, such as the terminal fitting should be designed so that it will not crack during normal flight, should it not?

[Objection as to form omitted]

Q. Isn't that correct?

A. I am told that, yes.

Q. Well, don't you know that from your thirty-one years with Boeing?

A. Experience would dictate that, yes, sir.

Q. Therefore, this terminal fitting on the KC-135 and the 707 was undersigned, wasn't it?

[Objection as to form omitted]

Q. *The terminal fitting on the KC-135 and the 707 did not meet this normal accepted design criteria, did it?*

[Objection as to form omitted]

A. *No,* it cracked and certainly the design didn't expect it to crack.

[Objection as to form omitted]

Q. The terminal fitting on the KC-135 and the 707 is a critical part, isn't it?

A. Yes.

Q. And a crack in a critical part such as a terminal fitting can lead to catastrophic failure of the aircraft, isn't that correct?

A. If not found and properly removed, it *would* result in complete failure.' "

Morgan Deposition (KC-135) (Exhibit "15") p. 48, l. 3, p. 50, l. 10 (Emphasis added)

Significantly, Mr. Morgan has testified that normal operations cause cracks to appear and:

"Q. The load which caused the crack, you know, do you not, will cause the crack to grow

[Objection as to form omitted]

A. Well, I will have to agree with him . . ."

Morgan Deposition (KC-135) (Exhibit "15") p. 88 l. 3-14

Fractures of the subject terminal fittings, which are failures of the fittings [Morgan Deposition (KC-135) (Exhibit "15") :3-7] occurred during normal operations [Morgan Deposition (KC-135) (Exhibit "15") p. 83:19—p. 84:5] and the same normal operations which caused the fracture to start caused it to grow [Morgan Deposition (KC-135) (Exhibit "15") p. 88:3-14; Ramsey Deposition (Exhibit "17") p. 107:18-23]. These fittings fractured because they

were improperly designed and underdesigned by Boeing and were not strong enough to carry the normal loads placed on them [Morgan Deposition (KC-135) (Exhibit "15") p. 85:22—p. 86:5; p. 94:11-29].

"Q. And the [fin body terminal] fittings were cracking because they were *not strong enough to carry the loads*?

[Objection as to form of question omitted]

Q. You were informed of this by Mr. Larsen, Mr. Hayden and other engineers, weren't you?

A. Yes."

Morgan Deposition (KC-135) (Exhibit "15") p. 48:3—p. 50:10 (Emphasis added)

"Q. Does that [redesigned stronger fitting] lead you to the conclusion that the *cause of the cracked [fin body terminal] fittings was underdesign of that fitting*?

[Objection as to form of question omitted]

A. I will answer the question the way I interpreted it. You are asking for my personal opinion?

Q. Yes.

[Objection as to form of question omitted]

A. *Yes.*"

Morgan Deposition (KC-135) (Exhibit "15") p. 94 l. 11-20 (Emphasis added)

"Q. *These cracks were occurring in aircraft that were being flown within the operational limits specified by Boeing,* were they not?

[Objection as to form omitted]

Q. The information you received in the ordinary course of business.

A. *It was such that the cracks did occur in normal operation after a time, after extended normal operation.*

Q. So you learned that the cracks in the fittings did begin to occur after a period of time with normal operation?

[Objection as to form omitted]

Q. Is that right?

[Objection as to form omitted]

Q. You can answer the question.

A. I was told that was the expressed decision.

Q. And you were told this by—was it Mr. Larsen, Mr. Hayden?

A. Yes.

Q. These are specialists in Structures?

A. Yes."

Morgan Deposition (KC-135) (Exhibit "15") p. 83:20—p. 84:22 (Emphasis added)

"Q. And the fittings were cracking because they were *not strong enough to carry* the loads?

[Objection as to form omitted]

Q. You were informed of this by Mr. Larsen, Mr. Hayden and other engineers, weren't you?

A. *Yes.*"

Morgan Deposition (KC-135) (Exhibit "15") p. 85:22—p. 86:5 (Emphasis added)

According to Boeing's Service Department Chief, Mr. Morgan, neither G-APFE nor any other 707 was designed strongly enough to carry loads experienced during normal flight and they required abnormal inspection [Morgan Deposition (KC-135) (Exhibit "15") p. 44, l. 19-45, p. 48, l. 3-18]. The terminal fittings were designed inadequately [Morgan Deposition (KC-135) (Exhibit "15") p. 41, l. 16 —p. 42, l. 7]. Defective design of the terminal fitting resulted in the fractures in the fitting holes [Morgan Deposition (KC-135) (Exhibit "15") p. 206, l. 2—p. 207, l. 3].

"Q. Well, the terminal fitting and the surrounding structure it turns out were designed inadequately, were they not?

[Objection as to form omitted]

A. I will have to say this, that it was designed so that it didn't allow utilization and service that we expected."

Morgan Deposition (KC-135) (Exhibit "15") p. 43:23 —p. 44:5

Boeing's tests showed that the right hand rear fin terminal fitting of G-APFE was 40% below the designed ultimate safety factor [Hansen Deposition (Exhibit "5") (Vol. II) p. 35:16-20; Smith Deposition (Exhibit "9") p. 44:17 —p. 45:10].

Moreover, the machining and reaming of the fin terminal fitting bolt holes by Boeing caused the fitting to fatigue on

all 707 aircraft [Morgan Deposition (KC-135) (Exhibit "15") p. 90:22—p. 92:5], which includes G-APFE.

Boeing knew of various continuing fracture problems associated with the fin terminal area of the 707 for nearly 6 years prior to the subject crash, which are detailed elsewhere herein at *Point V*. Nevertheless, Boeing did nothing prior to the subject crash to correct the defect (i.e. the terminal fitting design was not strengthened to accept normal loads without failure) [Morgan Deposition (KC-135) (Exhibit "15") p. 142:4—p. 146:14] which caused the subject crash. This was also the conclusion of Mr. Larsen, Boeing's Structures Technology Chief, Mr. Hayden of the Structures Group and Howard Smith, Boeing's Director of Program Management/Director of Engineering [Morgan Deposition (KC-135) (Exhibit "15") p. 142:4—p. 143:9].

"Q. All these problems [with respect to the fin body terminal fitting]—cracks in the skin, cracks in the bulkhead, cracked bolts, cracked fittings—they were all related, weren't they?

[Objection as to form omitted]

A. As far as I know, yes.

Q. As they were all related because the terminal fitting and the surrounding structure were not designed strong enough to take the loads they were placed on them when the aircraft, the 707, was in normal flight?

[Objection as to form omitted]

Q. Isn't that correct?

[Objection as to form omitted]

A. *I was led to believe that.*

Q. You were led to believe this *by your engineers?*
A. *Yes.*

Q. *Mr. Larsen?*
A. *Yes.*

• • • • •

Q. Who else told you this besides Mr. Larsen?
A. Hayden, Smith.

Q. Is he [Smith] in the Structures Department?
A. He used to be."

Morgan Deposition (KC-135) (Exhibit "15") p. 142:4—143:9 (Emphasis added)

"Q. The [post G-APFE accident] Service Bulletin calling for the strengthened terminal fitting and attachment terminal fitting and surrounding structures solved the basic problem?
A. To my knowledge, yes.

Q. But none of the prior fixes or Service Bulletins with respect to reaming or substitution of bolts solved the basic cause of the fatigue and cracking in the aft fin terminal attachment area?

[Objection as to form omitted]

Q. Isn't that correct?
A. Yes. Completely. It solved it completely.

Q. The complete solution was the strengthened terminal fitting, wasn't it?
A. Yes."

Morgan Deposition (KC-135) (Exhibit "15") p. 146:4-17 (Emphasis added)

"Q. And because it [strengthened terminal fitting and surrounding structures] was strong enough, you didn't get any cracks in the holes of the new terminal fittings?
A. At the time I left, there hadn't been any reported.

Q. Have you heard of any from Boeing men since you left?
A. No, sir."

Morgan Deposition (KC-135) (Exhibit "15") p. 198:4-8.

"Q. The cause of these cracks was removed when [post G-APFE Accident] Service Bulletin 2422 was compiled with, the subject substitution of the stronger, beefed-up terminal fitting?
A. Yes.

Morgan Deposition (KC-135) (Exhibit "15") p. 240:1-14 (Emphasis added)

•

Mr. Morgan has stated that while machining and reaming of fittings *by Boeing* undeniably contributed to the fatigue of the fittings, the primary reason that they fractured and failed, causing the subject crash, was they were *underdesigned.* The problem was corrected, after the crash of G-APFE, by redesign and imposition of stronger fittings and bulkhead [Morgan Deposition (KC-135) (Exhibit "15") p. 92:14-17].

In fact, Mr. Morgan testified in 1972 that the fractures, due to underdesign of the fitting, would have taken place with or without the presence of untempered martensite,

based on a review of metallurgical examinations of fin terminal fittings from various 707 aircraft after the crash. [Morgan Deposition (KC-135) (Exhibit "15") p. 206:7-10]. This was based on a review of six Boeing post-accident Metallurgical and Fractographic Analysis of Fin Terminal Fittings of various aircraft. The reports are *Boeing Metals and Standards Group Engineering Reports:* MS 971 (Exhibit "24"); 6-76-11 MS 988 (Exhibit "25"); 6-7600-MS-955 (Exhibit "26"); 6-7611-MS 946 (Exhibit "27") 6-7771-MS-853 (Exhibit "28") and 6-7611-MS 1010 (Exhibit "29").

Boeing *Metals and Standards Group Engineering Report MS 971* (Exhibit "24") dated April 3, 1967 states:

> "Comments: The poor surface finish and eccentricity conditions has been observed on numerous other fin terminal fittings examined after rework.
>
> • • • • •
>
> No untempered martensite was found.
>
> • • • • •
>
> The fin terminal fitting possessed a crack emanating from hole 1, the origin and nature of which, due to corrosion and rework, were not able to be determined." Exhibit "24", pp. 1-2

Boeing *Metals and Standards Group Engineering Report 6-7611 MS 988* (Exhibit "25"), dated April 20, 1967 states:

> "Due to the large number of fin terminal fittings examined in the past, a minimum investigation was performed in order to confirm the nature of the failure.
>
> • • • • •

> Fracture made was by *fatigue.*
>
> • • • • •
>
> Macroscopic examination of the fracture face showed typical fatigue striations."
>
> Exhibit "25", pp. 1-2

Boeing *Metals and Standards Group Engineering Report 6-7600-MS-955* (Exhibit "26"), dated March 9, 1967 states:

> "Failure was confirmed to be fatigue, originating at the intersection of the hole surface and the part surface."
>
> • • • • •
>
> No evidence of any untempered martensite or microstructural irregularities around the hole were observed. Exhibit "26", p. 3 (Emphasis added)

Boeing *Metals and Standards Group Engineering Report 6-7611-MS 946* (Exhibit "27"), dated March 15, 1967, states:

> "The fracture mode of cracks emanating from the upper outboard #1 hole to the flange edge in both fittings was *fatigue.*
>
> • • • • •
>
> No evidence of untempered martensite in the hole was seen or the micros examined."
>
> Exhibit "27" p. 1-3 (Emphasis added)

Boeing *Metals and Standards Group Engineering Report 6-7771-MS 853* (Exhibit "28"), dated August 16, 1966, concerns the vertical fin fitting fractures of the FAA 707 which were discovered a year prior to the crash of

G-APFE! [The background of which is detailed elsewhere herein at Point V]. The Report states:

> "The right and left hand fittings, contained fatigue cracks in the fastener holes that attach the fittings to the body frame at Sta. 1505. Untempered martensite and corrosion were found in the holes."
>
> * * * * *
>
> 1. The parts cracked by the initiation and growth of fatigue cracks in the top fastener holes."
>
> Exhibit "28", p. 1-2 (Emphasis added)

Boeing *Metals and Standards Group Engineering Report 6-7611-MS 1010* (Exhibit "29"), dated June 12, 1967, states:

> "Fracture of the fin terminal fitting was observed."
>
> Exhibit "29", p. 1-2 (Emphasis added)

It was after a review of these findings that Mr. Morgan, Boeing's Service Department Chief, agreed that it was an inescapable conclusion that fatigue fractures would occur without the presence of untempered martensite because the cause of these failures was the underdesign of the terminal fitting!

> "Q. Here you have five out of seven metallurgical examinations of fatigue cracks in bolt holes of terminal fittings of 707 aircraft where there is no untempered martensite, don't you?
>
> A. Yes.
>
> Q. Doesn't that lead you to the inescapable conclusion that you can get fatigue cracks in these bolts

> holes without the presence of untempered martensite?
>
> A. Yes.
>
> Q. And doesn't it lead you to the inescapable conclusion that untempered martensite in bolt holes is not the cause of these fatigue cracks but *its underdesign of the terminal fitting?*
>
> [Objection as to form omitted]
>
> Q. Isn't that correct?
>
> [Objection as to form omitted]
>
> A. I don't know. I wouldn't like to answer that one.
>
> * * * * *
>
> Q. Is that correct?
>
> A. *Yes, it would lead me to believe that that is the case."*
>
> Morgan Deposition (KC-135) (Exhibit "15") p. 206:2—p. 207:3 (Emphasis added)

Boeing was aware, and admits, that the terminal fittings on the 707 are a critical part of the subject aircraft, which, if they fail, will cause "catastrophic and complete failure of the aircraft" and, as designed, the fitting did not meet proper design criteria. [Morgan Deposition (KC-135) (Exhibit "15") p. 49:10—p. 50:10].

Boeing has admitted that the subject BOAC aircraft was inspected and deemed airworthy on January 28, 1966, two months before the crash [Larsen Deposition (Exhibit "16") (Vol. II) p. 60:25—p. 61:2; *BOAC Aircraft Inspection Records* 1/28/66 (Exhibit "30")].

If an inspection of the fin body terminal fittings had been made on January 28, 1966, however, a fracture in the bolt hole of the right hand vertical fin attachment would not have been visually observable to BOAC [Larsen Deposition (Exhibit "16") (Vol. II) p. 63:5-11]. Although undetectable, the cracks in holes R-1 and R-3 did, in the opinion of Mr. Larsen, exist on January 28, 1966 at which time the aircraft was inspected and found airworthy; moreover, there was no Boeing Service Bulletin providing for inspection which would or could discover it! [Larsen Deposition (Exhibit "16") (Vol. II) p. 66:25—p. 67:16].

In the opinion of Mr. Larsen, compliance by BOAC with all prior Service Bulletins on the aircraft could not and would not have revealed the presence of the fractured bolt or fractured fittings and BOAC would in fact have no way of knowing of either! [Larsen Deposition (Exhibit "16") (Vol. II) p. 69:9-15]. A crack on a fitting bolt could not be visually observed unless the crack had progressed to the outside of the bolt and fractured completely through [Morgan Deposition (KC-135) (Exhibit "15") p. 53:18-24].

It is significant that Mr. Larsen also testified that BOAC's Inspection Records for G-APFE show that the aircraft was airworthy less than two months before its disintegration, *according to inspections approved by Boeing* [Larsen Deposition (Exhibit "16") (Vol. II) p. 60:25—p. 61:2; BOAC *Inspection Records* 1/28/66 (Exhibit "28")]. Thus, defects which were undetectable by BOAC were known to Boeing for more than five years.

When Boeing delivered the subject aircraft to BOAC, it did not anticipate that fractures would develop in the fin terminal area. This was abnormal. [Larsen Deposition (Exhibit "16") (Vol. I) p. 20:2-23].

The fitting was not designed to fatigue at the time that it did [Morgan Deposition (KC-135) (Exhibit "15") p. 105:7-11]. Boeing's Service Department Chief Morgan also testified that the aircraft and its primary structures, which include the fin terminal fittings, should have been designed not to fatigue prior to the end of the aircraft's service life! [Morgan Deposition (KC-135) (Exhibit "15") p. 48:19-25; p. 81:14—p. 82:4].

When Boeing sold the subject aircraft to BOAC, it represented that it would provide service and support and would recommend improvements in the aircraft and its structures. [Morgan Deposition (KC-135) (Exhibit "15") p. 147:25—p. 148:7]. However, Boeing failed to comply with this representation since it never advised BOAC by warning, notice or otherwise, that the terminal fitting would fatigue and fracture. [Larsen Deposition (Exhibit "16") (Vol. 1) p. 50:16-20].

Boeing represented that the 707 had a service life of 50,000 to 60,000 hours or 20 years which meant that no failure of a primary structure would occur if the aircraft was operated within limits prescribed by Boeing with inspection and maintenance established by Boeing. [Morgan Deposition (KC-135) (Exhibit "15") p. 12:24-25 p. 13:3-11, p. 14:4-6; Larsen Deposition (Exhibit "16") (Vol. I) p. 51:10-24].

The subject aircraft and its fin terminal fittings failed in flight after less than 20,000 hours of flight and less than 6 years after its sale to BOAC. [Morgan Deposition (Exhibit "6") p. 50:1-14].

Beyond this, Mr. Morgan, Boeing's Service Department Chief, stated that with proper maintenance and inspection

the aircraft could be operated indefinitely [Morgan Deposition (Exhibit "6") p. 32:20—p. 33:6].

The service life of a particular aircraft is the time the aircraft can be used without failure of any primary structure. [Morgan Deposition (KC-135) (Exhibit "15") p. 27: 13-24].

The service life of 50,000 to 60,000 hours or 20 years represented for the 707 aircraft and for the terminal fittings of the 707 aircraft meant that both would last 50,000 to 60,000 hours or 20 years without failure if properly inspected and maintained, and at the sale of G-APFE Boeing did not specify any terminal fitting inspection or replacement specifications. [Morgan Deposition (KC-135) (Exhibit "15") p. 50:19—p. 51:16; Larsen Deposition (Exhibit "16") (Vol. I) p. 51:10—p. 52:23]. When the 707 was sold, a maintenance manual set forth maintenance and inspection requirements yet nothing was set forth therein with respect to terminal fittings in the maintenance manual, or anywhere else. [Morgan Deposition (KC-135) (Exhibit "15") p. 52:17—p. 53:17].

"Q. When the service life of fifty to sixty thousand hours was placed on the 707 by The Boeing Company, that included the terminal fittings on the aircraft, didn't it?

[Objection as to form omitted]

A. Not specifically that unit.

Q. What you mean is that when the represented service life of fifty to sixty thousand hours was set by Boeing, it meant that the primary structures,

critical structures, including this terminal fitting would last this long without failure?

[Objection as to form omitted]

A. If inspected and properly maintained, yes.

Q. When Boeing first sold the 707 and the KC-135 it didn't prescribe any inspection period for the terminal fitting, did it?

[Objection as to form omitted]

A. Not specifically.

Morgan Deposition (KC-135) (Exhibit "15") p. 50: 11—p. 51:8

The only Service Bulletin (1975 R-2) issued prior to this crash concerned bolts (Exhibit "31") [Larsen Deposition (Exhibit "16") (Vol. II) p. 59:10-14] which resulted in correcting neither fracturing of bolts [Larsen Deposition (Exhibit "16") (Vol. 1) p. 15:6—p. 16:11] nor the failure of the fittings and the bulkhead themselves [Morgan Deposition (KC-135) (Exhibit "15") p. 145:20—p. 146: 14], which caused this accident.

According to Mr. Morgan and Mr. Hansen, it was only *after* the accident and after Alert Bulletin 2422 (Exhibit "19") was complied with and stronger terminal fittings and a stronger bulkhead were designed and installed, that the problem was corrected and fractures ceased to occur [Morgan Deposition (KC-135) (Exhibit "15") p. 213:14-25, p. 240:1-4, p. 259:22—p. 260:9; Hansen Deposition (Exhibit "5") (Vol. II) p. 27:15—p. 28:10]. This also increased service life. Once this took place, *after* the

accident, there were no more reports of untempered martensite in any of the new stronger redesigned terminal fittings [Morgan Deposition (KC-135) (Exhibit "15") p. 103:1-4].

Boeing, through its Service Chief Morgan, has stated that the reason that Boeing Alert Service Bulletin 2422 was issued after the subject accident was that if the fin terminal fitting and its surrounding structures were not made stronger then other fittings would fail and other aircraft would be lost. [Morgan Deposition (KC-135) (Exhibit "15") p. 128:22—p. 129:3]. Therefore, Boeing issued Alert Service Bulletin 2422 *and* designed a fitting strong enough to carry normal loads [Morgan Deposition (KC-135) (Exhibit "15") p. 125:17-19].

Point IV

THE AIRCRAFT DISINTEGRATED WHILE IN STRAIGHT AND LEVEL FLIGHT AND WHILE BEING OPERATED WITHIN SPECIFICATIONS ESTABLISHED BY BOEING AS PROPER, IN FAIR WEATHER WITH UNLIMITED VISIBILITY AND IN CONDITIONS WHICH WERE NEITHER UNIQUE NOR UNUSUAL.

Boeing has established that there was nothing unique [Hogue Deposition (Exhibit "7".) p. 39:3-11] nor unusual [Hogue Deposition (Exhibit "7") p. 39:18-23] about the weather conditions on March 5, 1966 which existed at the time that the subject aircraft disintegrated in flight [Knutson[9] Deposition (Exhibit "32" p. 74:4-16].

[9] At all relevant times Donald C. Knutson was Boeing's Test Pilot.

The aircraft was being operated at a speed of approximately 335 knots at the time that it disintegrated [Hansen Deposition (Exhibit "5") (Vol. I) p. 99:19-25; Japanese Civil Aeronautics Board Aircraft Accident Report (Exhibit "8") pp. 3, 21] at an altitude of no lower than 12,000 feet [Hansen Deposition (Exhibit "5") (Vol. I) p. 96:19-22] nor higher than 17,000 feet [Hansen Deposition (Exhibit "5") (Vol. I) p. 31:15-24; Japanese Civil Aeronautics Board Aircraft Accident Report (Exhibit "8" p. 3]. The aircraft was represented as having been designed for safe operation at altitudes as high as 42,000 feet [Boeing 707-436 Flight Manual (Exhibit "33") Section I, p. 2]. The aircraft was being operated in straight and level cruising configuration at the time that it disintegrated [Japanese Civil Aeronautics Board Aircraft Accident Report (Exhibit "8") p. 13].

When G-APFE was sold to BOAC, Boeing was aware that the aircraft would be flown through weather of *all* types [Larsen Deposition (Exhibit "16") (Vol. I) p. 34:21-25] and it was even designed to fly in turbulent air [Knutson Deposition (Exhibit "32") p. 59:23-25].

"Q. Well let me ask you this: when that 707 [G-APFE] was delivered to BOAC, I guess Boeing knew that this was a plane that would be flown through weather of all kinds; correct?

A. Yes."

Larsen Deposition (Exhibit "16") (Vol. I) p. 34:21-25

"Q. Now, a 707 is designed to fly in turbulent air, is it not?

A. Yes."

Knutson Deposition (Exhibit "32") p. 59:23-25

The airplane was designed to withstand (and should have withstood) a two and one half "G" acceleration to limit load with a design safety factor added to that [Knutson Deposition (Exhibit "32") p. 20:15-17]. Therefore, the subject aircraft was designed to be flown, and should have been able to fly, through 2.5 plus or minus G's without anything going wrong and it should have withstood up to 3.75 G's before it started falling apart [Knutson Deposition (Exhibit "32") p. 22:18-25, p. 23:13-19]. There is no evidence that the subject aircraft ever approached these limits at any time.

The aircraft was properly loaded [Hansen Deposition (Exhibit "5") (Vol. I) p. 99:15-18].

According to Boeing the aircraft was being properly operated at 335 knots at an altitude of 12,000 to 17,000 feet at the time of the crash in that Boeing's 707-346 Flight Manual provides that a normal cruising speed at 12,000 to 17,000 feet is 359 knots or less [Exhibit "33", Section I, p. 11].

Point V

Boeing Had Been aware of Fractures of G-APFE's Vertical Fin Nearly Four Years Prior to Its Crash and of Defects of the Vertical Fin of Its 707 Fleet for Nearly Six Years Before This Accident.

In July of 1962, Boeing received in the State of Washington a series of Field Service Reports dealing with the subject BOAC aircraft G-APFE. The field Service Reports (Exhibit "34") were prepared by and received from

Boeing Field Service Representative Vogwill (stationed with BOAC in London) concerning new cracking and crack propagation taking place in a doubler 5-86003-3073 of the fin terminal area of G-APFE. [Larsen Deposition (Exhibit "16") p. 6:11, p. 7:12; (Exhibit "34" p. 1] dated July 31, 1962.

The doubler reinforces the fin fitting attachment [Larsen Deposition (Exhibit "16") p. 10:19-24]. The doubler cracks were caused by overstress from the horizontal and vertical stabilizers of the tail [Larsen Deposition (Exhibit "16") (Vol. 1) p. 22:6-15]. This Field Service Report, despite the admission that fracture propagation was taking place, merely directed BOAC to maintain records of the fractures [Larsen Deposition (Exhibit "16") (Vol. 1) p. 24: 4-18].

Boeing stations Field Service Representatives with an air carrier or military unit to obtain information on any problem and to coordinate with Boeing's home office in Washington [Morgan Deposition (KC-135) (Exhibit "15") p. 6:7-23]. Reports of malfunctions would be delivered to the Boeing Reliability Group, which was part of the Service Group, for the purpose of determining ultimate solutions and remedies. [Morgan Deposition (KC-135) (Exhibit "15") p. 7:3-20, p. 67:22—p. 68:6]. In the case of fractures, the problem was also brought to the attention of Mr. Larsen of Boeing's Structures Group who would be best able to prescribe remedies [Morgan Deposition (KC-135) (Exhibit "15") p. 68:15-23].

BOAC, in conformity with the direction of Boeing's Field Service Representative Vogwill, completed a "Special Check Form" (Exhibit "35"), dated August 1, 1962, stating that cracks had been discovered in B5-86003-3073 doublers

on the subject aircraft at the left- and right-hand side running forward from the inboard corner of the doublers from the fin rear spar attachment fittings at Station 1505 on the bulkhead. [Larsen Deposition (Exhibit "16") (Vol. 1) p. 28:20—p. 29:8].

Fatigue cracks and corrosion were thus discovered in the doublers of the fin body terminal fittings of G-APFE, but at no time prior to March 5, 1966 did Boeing recommend a Special Inspection of fin body terminal fittings for fractures, martensite or other defects [Morgan Deposition (Exhibit "6") p. 55:16—p. 56:41], nor did Boeing undertake to redesign the fin, body terminal fitting or bulkhead.

In 1962 fractures of the doublers of the fin body fittings were discovered. In 1964 fractures of the fin body attachment fitting *bolts* were discovered [Morgan Deposition (Exhibit "6") p. 44:13—p. 45:25]. This notwithstanding, and despite the fact that Boeing's Service Department in Washington knew of this problem and knew of vertical fin fractures in *many other* 707 aircraft, no one at Boeing correlated these facts, questioned these results or called for inspection other than those established at the time the aircraft was designed and sold [Morgan Deposition (Exhibit "6") p. 41:15-21, p. 44:18—p. 45:25] which did not call for inspection or replacement of fin body terminal fittings [Morgan Deposition (KC-135) (Exhibit "15") p. 50:19—p. 51:16] and which *would not, therefore, have revealed fractures.*

> "Q. By *1964*, when bolts in these fittings began to corrode and develop fatigue cracks and some even relate or even question any relationship between the cracks in these doublers and the bolts that were failed?
>
> A. I'm sure they did not."
>
> Morgan Deposition (Exhibit "6") p. 41:15-21 (Emphasis added)

Such an inspection was ordered by Boeing Alert Service Bulletin 2422 only *after, and as a result of the subject crash* [Hogue Deposition (Exhibit "7") p. 16:1-6; Morgan Deposition (KC-135) (Exhibit "15") p. 128:22—p. 129:3].

After the 707 was put into operation, fatigue problems developed almost immediately in the terminal attachment area of the bulkhead. [Morgan Deposition (KC-135) (Exhibit "15") p. 131:6-16, p. 132:18—p. 133:6] and in the fuselage skin [Morgan Deposition (KC-135) (Exhibit "15") p. 134:16-19].

The first failure of a 707 vertical fin fitting took place in 1960 [Morgan Deposition (KC-135) (Exhibit "15") p. 148:8—p. 150:20] which is analyzed in Boeing's *Metals and Standards Group Engineering Report 6-7773-MS 146* (Exhibit "36") of May 25, 1960. Significantly, page 1 of the Analysis shows distribution to Alvin C. Larsen, Boeing's Structures Technology Chief. The Analysis states:

> "Microscopic examination of the fracture surface revealed a brittle type failure and one growth ring, both of which are *indicative of fatigue.* Microscopic examination of a section through the fracture revealed it to be transangular in nature which is *once again indicative of failure.*" Exhibit "36", p. 2 (Emphasis added)

Mr. Morgan testified that as Chief of Boeing's Service Department he would find this 1960 report of the first *crack* in a 707 vertical fin of "considerable interest" [Morgan Deposition (KC-135) (Exhibit "15") p. 153:21-24].

> "This failure was the first noted in the fitting, thus the reason for cracking was of considerable interest." Exhibit "36", p. 1

The first failures of the fuselage bulkhead at Station 1505 (where fin attaches to bulkhead) were prior to July 17, *1962* [Morgan Deposition (KC-135) (Exhibit "15") p. 166:16—p. 167:16] which was reflected in Boeing *Metals and Standards Group Coordination Sheet SU-717-B433: Fin Terminal Attachment* (Exhibit "37"), dated July 17, 1962, which states:

> "An effort is being made to find if excessive bolt hole dimensions are responsible for *cracking of reinforcing at Sta. 1505.87, which has become a considerable problem on the commercial fleet* [707], and may show up on the C-135 [military] fleet" Exhibit "37" p. 1 (Emphasis added)

This information would have been forwarded to the Reliability Group as well as other groups for recommendation of corrective measures [Morgan Deposition (KC-135) (Exhibit "15") p. 169:4-10]. All such reports come in through Boeing's Field Representatives to the Boeing Reliability Group [Enright[10] Deposition (KC-135) (Exhibit "38") p. 15:13-22].

[10] At all relevant times Thomas P. Enright was the Chief of Boeing's Product Assurance Reliability Unit.

At no time prior to the crash of BOAC's G-APFE aircraft, however, was anything done by Boeing which corrected the problem, and which strengthened the bulkhead and fitting which failed [Morgan Deposition (KC-135) (Exhibit "15") p. 142:4-21—p. 145:20—p. 146:14], causing the crash of G-APFE.

Subsequent to the issuance of Boeing *Metals and Standards Group Coordination Sheet SU-717-B443* (Exhibit "37") on July 17, 1962, a subsequent Boeing *Metals and Standards Group Coordination Sheet No. 6-7741-52-53C* (Exhibit "39"), dated July 26, 1963, was prepared as a follow-up reference to the earlier Coordination Sheet, and states:

> "An inspection was performed on the fin terminal attachment (Sta. 1505.87) of the [Military 707] static test article located in the north boneyard at Boeing Field. The purpose of this inspection was to determine the hole sizes in each part of the attachment. A crack approximately 1.0 to 2.0 inches long was noted in the body skin just aft of the *fin attachment* on the left side." Exhibit "39" p. 1 (Emphasis added)

Exhibit "39" contains a drawing of the failed fitting on page 5 which also contains certain handwritten notes:

> "It appears that the S.I.R. was unnecessary: however in view of the *chronic problems on the 707* and our hydrostatic history: inspection of a typical high time airplane in this area *gives us some indication of fleet condition.*" Exhibit "39", p. 5 (emphasis added)

This was signed by "Art Lane", who is employed by Boeing [Morgan Deposition (KC-135) (Exhibit "15") p.

179:10-23]. It is most relevant that between *1960* when the first vertical fin fitting fractures were discovered and July 17, *1962* when fractures of the 1505 fitting attachment bulkhead station were discovered, that Boeing considered such fractures to be "chronic" and a matter of "history" and representative of the condition of their 707 fleet.

Again, on December 7, *1962,* Boeing *Metals and Standards Group Coordination Sheet No. W-3011: Control of Interchangeable Points—Fin Body Attachment* (Exhibit "40") was issued, concerning the same problem area. The document states:

> "*Doubler plates on the body skin around the aft fin terminal fittings have recently cracked on several* [*military 707*] *airplanes.* Misalignment between fin fittings and body fittings could be a contributing cause." Exhibit "40", p. 1 (Emphasis added)

More than a year before the subject crash in 1964, the FAA had found broken bolts on the rear terminal fittings of one of its 707 aircraft which was brought to Boeing's attention. Subsequent to the subject crash, Richard Morgan, Boeing's Service Department Chief, had a telephone conversation with Malcolm Anderson, a BOAC Engineer, on May 10, 1966 concerning the 707 vertical fin and proposed improvements. A transcript of that telephone conversation (Exhibit "41") was made and identified by Mr. Morgan as true and accurate [Morgan Deposition (KC-135) (Exhibit "15") p. 277:11-13, p. 282:23—p. 283:1; Morgan Deposition (Exhibit "6") p. 67:13—p. 68:5]. The transcript reveals:

> "[Anderson]: The previous list [of fractures] was incomplete for a start and the numbers of cracked

> fittings found by other operators compared with BOAC didn't seem to make sense.
>
> [Morgan]: You mean in respect of the few cracked fittings or cracks that other operators were finding?
>
> [Anderson]: That's right. The picture now looks rather more credible to me.
>
> [Morgan]: *You did change many more fittings than anybody else. Maybe this was because you didn't choose to go to the tolerances we allowed.*
>
> • • • • •
>
> [Morgan]: There is a new fitting *already designed* and being worked on. We hope they will be available starting in September.
>
> [Anderson]: September of this year?
>
> [Morgan]: Yes, and the idea there is that we want to make up an assembly that will include the two new fittings, a section at least of the circumferential—the frame of the fuselage to which they tie; a good section of the bulkhead because of the corrosion we find under the fittings and a good part of the fuselage skin around the fittings that you know we found cracks in. Hopefully, we can make this some sort of an assembly that you can go in there and cut the old area out and lift it out and put in a new assembly. Of course, that will have to be done on all aeroplanes.
>
> • • • • •
>
> [Anderson]: . . . I think you are familiar with the situation which arose *when we looked rather more carefully than you required us to at the front fitting.*

[Morgan]: Yes, I am. You found a crack you were able to work out.

[Anderson]: We were able to work it out and Ian Vogwill telephoned you and you OK'd the limits—yes indeed.

[Morgan]: Along that line, do you remember *a year or so ago on the FAA flying we found a broken bolt in that fitting, a good number of them. I think it was about eight of them on each of the fittings we found broken—that was the first indication of trouble. . . . And you know we found visually that two fittings on that aeroplane cracked, had big cracks in them.* Because of that use that aeroplane gets we, a couple or three weeks ago, went down and had the forward fittings on that aeroplane looked at." Exhibit "41", p. 1 (Emphasis added).

It now appears that Boeing had "tolerances" on cracks and that when BOAC had found a fractured fitting Messrs. Vogwill and Morgan had "ok'd" the "tolerances" or "limits". It further develops that this was discovered by BOAC because they looked "more carefully" than Boeing required. Significantly, BOAC found more cracked fittings because *they replaced them more frequently than Boeing required* and because BOAC didn't choose to approach the "tolerances" approved by Boeing.

Boeing, in May of 1966, just two months after the accident, had developed a stronger fitting and bulkhead for the vertical fin, which will arrest fracture problems [Morgan Deposition (KC-135) (Exhibit "15") p. 92:14-17]. They never chose to impose this design change until after

the crash, however, despite the fact that it took just two months to do so after the crash.

With respect to the cracks in the vertical fin fitting of the FAA 707, Mr. Larsen confirmed Mr. Morgan's statement that they were large cracks [Larsen Deposition (Exhibit "16") (Vol. II) p. 78:9-11].

In early *1964,* failed and fractured bolts were found on the subject FAA aircraft, which is reflected in Boeing *Metals and Standards Group Engineering Report No. 6-7773 MS 497* (Exhibit "42") dated March 19, *1964.* By this time, according to Howard Smith, Boeing's 707 Program Manager, Boeing was well aware that the bolts were cracking [Smith Deposition (Exhibit "9") p. 53:24—p. 55:11]. The Report states:

"Several failed fasteners (MS20005, BAC B30HC) from airplane 720 N 113 were submitted by the FAA to determine the possible cause of failure. *Examination of failed fasteners revealed that failures were initiated by corrosion and propagated in fatigue until fracture occurred.*

* * * * *

The FAA recently reported a number of failures of MS20005 and BAC B30HC fasteners from the Vertical Fin Attach Fitting installation of their 720 N113 airplane (3,432 hours total flight time). These failed fasteners were submitted to The Boeing Company for examination and possible determination of the cause of the failure. . . . Ten of the MS20005 bolts submitted and four of the BAC B30HC lockbolts were totally fractured and the rest showed evidence of yielding in shear, extending circumferentially around the shank.

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> . . . The failures of the MS20005 bolts appear to have occurred at the interfaces of the upper Center Web (5-86003-20) and the Terminal Fin Body Attachment (5-84487). . . . Some of the MS20005 bolts showed evidence of corrosion and all of the fasteners submitted had plating worn off along the shank. One of the MS20005 bolts was fractured in two places . . . . *The failure near the head was from fatigue through half of the bolt diameter and the total failure was probably also from fatigue. . .*"
>
> Exhibit "42" p. 1-3 (emphasis added)

Mr. Larsen, Boeing's Structures Technology Chief, confirms that in March of *1964,* cracks were found in hole R-1 of the subject FAA aircraft, as well as untempered martensite, corrosion and rust [Larsen Deposition (Exhibit "16") (Vol. II) p. 89:13—p. 90:7].

In March of *1964,* Boeing was also aware that the bolts of fin terminal fittings had fractured on Braniff, Pan American, United Airlines and TWA 707's, as well as the FAA 707 and that all fatigue fractures had propagated by fatigue and corrosion. [Larsen Deposition (Exhibit "16") (Vol. II) p. 91:13—p. 92:22].

The fracture situation with respect to the FAA aircraft was again made the subject of a study later that year in Boeing *Metals and Standards Group Engineering Report 6-7773 MS 526 R* (Exhibit "43") dated June 11, *1964* [Larsen Deposition (Exhibit "16") (Vol. II) p. 81:12—p. 82:5-22] at which time *more* failed bolts were found on the same FAA aircraft:

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> "A fractured NAS 1105-14 bolt was examined to determine the *cause of failure.* Examinations *identified the failure as fatigue.*
>
> • • • • •
>
> One failed NAS 1105-14 bolt from vertical fin attach fitting installation of airplane N113 was submitted by the FAA for analysis . . . It was determined by visual and electron microscopic examination of the fracture face . . . that *this bolt failed from fatigue.*
>
> • • • • •
>
> *Discussion*
>
> *In view of the reported low time on this bolt, a fatigue failure deserves particular scrutiny.* The most likely conjecture about the cause of failure appears to be the possibility of substantial bending stresses having been introduced into the bolt possibly due to excessive axial misalignment of the bolt hole."
> Exhibit "43", p. 1-3 (Emphasis added)

This was not the last report of vertical fin fractures on the same FAA aircraft, for on August 17, 1966, Boeing *Metals and Standards Group Engineering Report No. 6-7771 MS 853: Evaluation of Two Fractured Fin Body Terminal Fittings From FAA 720 A/P N113* (Exhibit "28") was issued. It states:

> "*The right and left hand fittings contained fatigue cracks* in the fastener holes that attach the fitting to the body frame at Sta. 1505. Untempered martensite and corrosion were found in the holes.
>
> • • • • •

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"CONCLUSIONS

1. *The parts cracked by the initiation and growth of fatigue cracks in the top fastener holes.*"

Exhibit "28", p. 1-2

Boeing's Service Chief Morgan testified concerning a summary of vertical fin fitting inspections of various 707 aircraft made shortly after the G-APFE crash. The document (Exhibit "44") was prepared by Boeing [Morgan Deposition (KC-135) (Exhibit "15") p. 271:8-18] and approved by Mr. Enright Boeing's Reliability Group Chief [Enright Deposition (KC-135) (Exhibit "38") p. 24:1—p. 26:22].

Seventy aircraft were found with cracked fittings of the 166 which were inspected [Morgan Deposition (KC-135) (Exhibit "15") p. 272:1-22, p. 273:1-2; Exhibit "44"].

Eighty-three per cent of Continental Airlines vertical fin fittings were found fractured [Morgan Deposition (KC-135) (Exhibit "15") p. 273:16-18]. United Airlines had seventy-four per cent of its vertical fin fittings fractured [Morgan Deposition (KC-135) (Exhibit "15") p. 273:19-21; Exhibit "44"].

Thirty-two per cent of all fittings inspected were found fractured and thirty-two per cent of BOAC's vertical fin fittings were found to be fractured (Exhibit "44").

Mr. Morgan testified that Boeing document, *Reported Significant 707/720/727 Fuselage and Door Structural Problems* (Exhibit "45"), dated March 16, 1967, sets forth a compilation of vertical fin rear spar body terminal fitting fractures at fuselage bulkhead Station 1505 [Morgan Deposition (KC-135) (Exhibit "15") p. 213:14-25] which was released on August 15, 1966. The report states:

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"The *vertical fin rear spar body terminal fitting is cracking in the four upper bolt holes* of each fitting that attach the fitting to body station 1505 bulkhead.

* * * * *

CAUSE

Fatigue (M.S. Report 6-7611-M.S. 946) and (M.S. Report 6-7611, M.S. 1010)."

Exhibit "45" p. 2 (Emphasis added)

According to the study, 222 such fittings were found cracked and defective [Morgan Deposition (KC-135) (Exhibit "15") p. 246:12—p. 247:17; Exhibit "45"].

On December 7, 1966, Boeing, through its Military Service Unit Chief Greer Moore, admitted the following in a letter to the United States Air Force (Exhibit "46") with respect to the 707 vertical fin fitting:

"*[I]t is impossible to predict the crack growth rate once a crack has originated in this [vertical fin terminal] area . . .*"

Exhibit "46", p. 2, Par. 10 (Emphasis added)

In a subsequent letter of January 1, 1967 to the Air Force (Exhibit "47") Moore states with respect to the vertical fin fitting of the 707:

"For purposes of clarification *a failure is defined as any crack or cracks* found during compliance with Service Bulletin 2399.

* * * * *

3. Commercial experience has shown that once a crack develops at the fraying surface edge of the bolt hole

the crack usually progresses outboard and that most develop in the upper outboard hole of each fitting. *Once the crack has reached the outboard edge the crack then usually progresses inboard. It is the cracking inboard of the hole that might produce catastrophic results if undetected.*"

Exhibit "47", p. 1-2 (Emphasis added)

After the crash of G-APFE, Boeing redesigned the fin rear terminal fitting and bulkhead to be much stronger and to accept normal loads. Boeing *Job Description* dated December 6, 1967 (Exhibit "48") and signed by Mr. McLaughlin of Boeing's Engineering Department describes the strengthened fitting and bulkhead and makes the following statement:

"DISCUSSION

A NUMBER OF BOEING 707 AIRPLANES IN COMMERCIAL SERVICE HAVE EXPERIENCED FATIGUE FAILURES OF THE FIN TERMINAL FITTINGS LOCATED ON BULKHEAD 1505. FAILURES OCCURRED IN THE TOP FOUR BOLT HOLES OF THE FIN TERMINAL FITTINGS AND HAVE BEEN ATTRIBUTED TO BENDING STRESSES RESULTING FROM THE FIN SIDE LOAD. THE TERMINAL FITTING AND THE SIDE LOAD REACTING STRUCTURE WERE REDESIGNED AND INSTALLED AS A NEW PRODUCTION DESIGN IMPROVEMENT. A RETROFIT KIT ACCOMPLISHING THE INTENT OF THE DESIGN IMPROVEMENT WAS MADE AVAILABLE FOR THE IN SERVICE FLEET.

AN ANALYSIS OF THE CRITICAL AREAS OF THE DESIGN IS INCLUDED IN THIS REPORT.

RESULTS FROM THE COMPARATIVE FATIGUE TESTS CONDUCTED AT BOEING (TEST REPORT T6-3577) SHOW THE IMPROVED FITTING TO HAVE A FATIGUE LIFE EIGHT TIMES THAT OF THE ORIGINAL DESIGN."

Exhibit "48", p. 1 (Emphasis added)

There can be no dispute that Boeing's original vertical fin terminal fittings and bulkhead were defectively designed and underdesigned in view of a redesigned fitting which was required to be eight times stronger than the original fitting in order to prevent the vertical fin from separating from the aircraft in normal flight.

Point VI

Plaintiff BOAC is Entitled to Partial Summary Judgment on the Issue of Liability Under the Washington Law of Strict Tort Liability.

Under the law of Washington, applicable hereto, a manufacturer is strictly liable in tort for damages caused by a defective product. *Ulmer* v. *Ford Motor Co.*, 75 Wash. 2d 522, 452 P.2d 729 (1969). This liability results from the placing of a dangerous product into the stream of commerce which creates an unreasonable risk of harm. Washington has adopted the strict tort liability concept embodied in Section 402A of the Restatement (Second) of Torts (1965) as it relates to manufacturers of defective products. *Ulmer* v. *Ford Motor Co., supra; Baker* v. *City of Seattle,*

79 Wash. 2d 198, 484 P.2d 405 (1971); *Brown* v. *Quick-Mix Co.*, 75 Wash. 2d 833, 454 P.2d 205 (Wash. 1969); *Curtiss* v. *Young Men's Christian Association*, 7 Wash. App. 98, 498 P.2d 330 (Div. 2, 1972); *Reilly* v. *King Blood Bank, Inc.*, 6 Wash. App. 172, 492 P.2d 246 (Div. 1, 1971).

The basis of liability expressed in Section 402A is:

> "(1) One who sells any product in a defective condition unreasonably dangerous to the user or consumer *or to his property* is subject to liability for physical harm thereby caused to the ultimate user or consumer, *or to his property* . . . ." (Emphasis added). Restatement (Second) of Torts (1965).

The holding of *Ulmer* v. *Ford Motor Co., supra,* establishing strict liability in tort for defective products as the rule in Washington, has also been adopted in property damage actions. *Bombardi* v. *Pochel's Appliance & T.C. Company,* 9 Wash. App. 797, 515 P.2d 540 (Div. 2, 1973).

> "Stric liability in tort does apply to physical harm caused to the ultimate user or consumer, *or to his property.*" (emphasis by Court) 9 Wash. App. at 806, 515 P.2d at 544.

This action involved a defective television set which caught fire destroying plaintiff's property and causing personal injuries. Recovery for plaintiff affirmed, based on the strict tort liability of the manufacturer. *Berg* v. *Stromme,* 79 Wash. 2d 184, 195, 484 P.2d 380, 386 (1971); *Lamphiear* v. *Skagit Corporation,* 6 Wash. App. 350, 493 P.2d 1018 (Div. 2, 1972); *See also, Sterner Aero AB* v. *Page Airmotive Inc.,* 499 F.2d 709 (10th Cir. 1974); *Hales*

v. *Green Colonial Inc.,* 490 F.2d 1015 (8th Cir. 1974); *Dennis* v. *Ford Motor Company,* 471 F.2d 733 (3rd Cir. 1973).

In *Lamphiear* v. *Skagit Corporation, supra,* plaintiff was doing business as a logging company and had purchased a portable logging spar from the defendant manufacturer for use in its business. The portable logging spar collapsed and plaintiff brought an action for property damage and loss of profit based on a theory of breach of warranty. The trial court applied the strict tort liability rule of *Ulmer* v. *Ford Motor Co., supra,* and plaintiff recovered judgment for property damage and lost profits. Affirming the result, the Court of Appeals acknowledged the elements of a strict tort liability claim:

> "(1) A manufacturing defect existed;
>
> (2) The defect rendered the product unreasonably dangerous; and
>
> (3) Such defect was a proximate cause of plaintiff's damages." 6 Wash. App. at 352, 493 P.2d at 1021.

Washington strict tort liability, as enunciated in *Ulmer* v. *Ford Motor Co., supra,* was applied in *Manos* v. *Trans World Airlines, Inc.,* 324 F. Supp. 470 (N.D. Ill. 1971), to the issue of whether the thrust reverser of an aircraft manufactured by defendant Boeing was defective. The Court found that the characteristics of the thrust reverser to develop substantial forward thrust and the lack of an instrument or device to inform the crew that an engine was not in the reverse thrust position when it was intended to be, rendered the aircraft unreasonably dangerous and entered judgment against the manufacturer.

The District Court in *Manos* v. *Trans World Airlines, Inc., supra,* found the strict tort liability enunciated in *Ulmer* v. *Ford Motor Co., supra,* to be a "refining and relabeling" of prior Washington law which established liability without proof of negligence where a product created an unreasonable risk of harm. The Court stated:

> "An aircraft would certainly qualify under such earlier case law as a product which carries an unreasonable risk." *Id.* at 484.

Where a claim was made based on the Oklahoma Manufacturer's Product Liability Doctrine, the United States Court of Appeals for the Tenth Circuit acknowledged its applicability where plaintiff sought recovery solely for the property damage to the aircraft it purchased. *Sterner Aero AB* v. *Page Airmotive, Inc.,* 499 F.2d 709 (10th Cir. 1974).

A similar result was reached in *Hales* v. *Green Colonial Inc.,* 490 F.2d 1015 (8th Cir. 1974), where, in an action for the loss of plaintiff's store premises, the Court agreed that Section 402A extends strict tort liability to property damage as well as to physical harm. *Id.* at 1021. *See also, Dennis* v. *Ford Motor Co.,* 471 F.2d 733 (3rd Cir. 1973), (where plaintiff's truck-tractor was damaged due to a defect in the steering; Pennsylvania strict tort liability was applied).

An inherent design defect is within the strict tort liability of Restatement Section 402A, as adopted by the Supreme Court of Washington in *Ulmer* v. *Ford Motor Co., supra; Runnings* v. *Ford Motor Co.,* 461 F.2d 1145 (9th Cir. 1972); *Palmer* v. *Massey Ferguson Inc.,* 3 Wash. App. 508, 476 P.2d 713 (Div. 2, 1970). Washington has even gone as far as to allow strict tort liability recovery when a design defect, although not the cause of the original loss, enhances the injuries of plaintiff. *Seattle-First National Bank* v. *Volkswagen of America, Inc.,* 86 Wash. 2d 145, 542 P.2d 774 (1975). *Baumgardner* v. *American Motors Corporation,* 83 Wash. 2d 751, 522 P.2d 829 (1974).

These extensions of the strict tort liability concept are a pragmatic realization that the complexity of contemporary means of transportation makes it impossible for the user-operator to know the intricacies of its construction and structural integrity. This enlightened judicial view is a recognition that *caveat emptor* is no longer a viable doctrine in the modern technological age. *Accord, Gay* v. *Cornwall,* 6 Wash. App. 595, 494 P.2d 1371 (Div. 2, 1972).

The situation presented by the instant case falls squarely into the standards mandating recovery in tort, based on the strict liability of the manufacturer of a defective product. It is admitted by Boeing that the terminal fitting and bulkhead were both defective in design and manufacture. Additional defective manufacture is evidenced by the presence of untempered martensite. Such defects at a critical point of stress, rendered the product unreasonably dangerous. Finally, the consequence of the use of the defective product was the crash and the resultant destruction of the subject aircraft.

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Point VII

Boeing Breached Its Duty to Inspect the Aircraft and Its Duty to Warn of Defects in Design and Construction.

Boeing had a continuing duty to inspect aircraft G-APFE and to provide field supervision for the ongoing maintenance of the aircraft. During the course of the inspection and maintenance supervision of the subject aircraft, Boeing representatives became aware of the fatigue fractures in the area of the vertical fin fittings aand bulkheads. BOAC engineers were merely requested by Boeing to keep records of the cracks.

Boeing, due to the large number of these aircraft being operated by airlines other than BOAC, was in the best position to be aware of the extent of this defect and moreover, to analyze and correct it. BOAC was never advised by Boeing that the subject defect rendered the aircraft unable to withstand normal operation without failure.

Although the use of the aircraft itself was not unreasonably dangerous, the presence of the defective terminal fitting and bulkhead rendered it so. The potential for loss in an airplane crash is so great that a structural defect which creates the possibility of product failure is clearly within the scope of §402A of the Restatement.

As one early case dealing with aircraft manufacturer liability described:

> "While the airplane manufactured or repaired is not an inherently dangerous vehicle, it was designed, manufactured and repaired to fly in the air, and unless it is made or repaired without mechanical defects it becomes a thing of danger to all in the range of probable forseeability." *Vrooman* v. *Beech Aircraft Corp.* 183 F.2d 479, 481 (10th Cir. 1950).

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Liability for failure to inspect and the concomitant duty to adequately warn of the potential danger inherent in a product is well established and is a "logical inference from the manufacturer's duty to exercise reasonable care throughout the manufacturing process." *Ewer* v. *Goodyear Tire and Rubber Company,* 4 Wash. App. 152, 161, 480 P.2d 260, 267 (Div. 3, 1971); See also, *Chrysler Motor Corporation* v. *Andresen,* 76 Wash.2d 20, 454 P.2d 825 (1969); *Callahan* v. *Keystone Fireworks Manufacturing Company,* 72 Wash.2d 823, 453 P.2d 626 (1967).

Ewer v. *Goodyear Tire and Rubber Company, supra,* involved the situation where defective tires, manufactured by defendant, exploded when being mounted on tire rims. The significance of the holding is that the Court agreed there was a duty to warn those in the tire business since the risk of "bead breaking" on tires, due to defective sidewall construction, is not contemplated in the normal course of mounting and usage. Likewise, a duty to warn of the potential danger in the instant case arose since the loss of the tail section of an aircraft due to fin terminal fitting and bulkhead failure is not contemplated by those operating the aircraft.

Indeed, the duty to warn is so much a part of the duty of a manufacturer that the Supreme Court of Washington declared:

> "It is not necessary to specifically allege that the duty to exercise due care included the duty to warn." *Callahan* v. *Keystone Fireworks, supra,* 72 Wash. 2d 823 at 826, 435 P.2d 626 at 629.

Boeing had a continuing duty to warn BOAC of the inherent design defect and its potential for deterioration. The failure to adequately warn BOAC of this latent danger was a breach of Boeing's contractual duty and its duty as a manufacturer. *Chrysler Motor Corporation* v. *Andresen, supra; Callahan* v. *Keystone Fireworks Manufacturing Co., supra; Braniff Airways* v. *Curtiss-Wright Corp.*, 411 F.2d 451 (2d Cir. 1969) *cert. denied,* 396 U.S. 959 (1968); *Noel* v. *United Aircraft Corp.*, 342 F.2d 232 (3rd Cir. 1964); *Boeing Airplane Co.* v. *Brown,* 291 F.2d 310 (9th Cir. 1961); *Sieracki* v. *Seas Shipping Co.*, 149 F.2d 98 (3rd Cir. 1945), *cert. denied,* 326 U.S. 701 (1945); *Connor* v. *Dayton Rogers Manufacturing Co.*, 377 F.Supp. 937 (E.D. Ky. 1974); *Powell* v. *E. W. Bliss Co.*, 346 F.Supp. 819 (W.D. Mich. 1972).

In *Branic Airways, Inc.* v. *Curtiss-Wright Corporation, supra,* the defendant manufacturer was aware of "scuffing" difficulties on its engine prior to the crash but failed to warn the plaintiff airline of the weakening effect this had on the cylinder walls. The Court stressed the duty to adequately warn of the potential danger.

> "It is clear that after such a product has been sold and dangerous defects in design have come to the manufacturer's attention, the manufacturer has a duty either to remedy these or, if complete remedy is not feasible, at least to give users adequate warnings and instructions concerning methods for minimizing the danger." 411 F.2d at 453.

Knowledge and awareness by the manufacturer of defects creating a heightened risk of danger without making

efforts to correct the defects will make the manufacturer liable. "Foresight of consequences creates a duty, the violation of which is an actionable wrong." *Vrooman* v. *Beech Aircraft Corp., supra,* 183 F.2d at 481.

The defendant propeller manufacturer in *Noel* v. *United Aircraft Corporation, supra,* was held liable for permitting the development of an effective safety device to lag behind similar developments for other aircraft. The Court specifically rejected the defendant's contention that there was no continuing duty to develop improvements *after delivery* of the aircraft. Admissions by United showed that the need for an effective means of controlling the phenomenon of "overfeathering", which caused the loss of control of the aircraft, was apparent to United engineers, yet they failed to correct the problem or warn the users of the aircraft of the potential danger.

In both the *Braniff* and *Noel* cases, emphasis was placed on the defendant's knowledge of the defect prior to the product failure. The United States Court of Appeals for the Second Circuit in *Braniff Airways Inc.* v. *Curtiss-Wright Corporation,* found evidence that defendant Curtiss-Wright knew of "scuffing" problems and cylinder barrel separation eight months before the crash but did nothing to remedy it. 411 F.2d at 453. In *Noel* v. *United Aircraft Corp.,* the United States Court of Appeals for the Third Circuit alluded to the findings of the Trial Court that United knew several years earlier of the "overfeathering" problem, yet did not correct it when the means were available, nor warn users of its inherent deficiency. 342 F.2d at 237.

It appears that during the course of Boeing inspections certain instructions were given with regard to keeping

records of the fatigue cracks which were appearing on various 707 aircraft. However, as *Conner* v. *Dayton Rogers Manufacturing Co.*, 377 F.Supp. 937 (E.D. Ky. 1974) makes clear, mere instructions are insufficient to meet the requirements of an adequate warning to negate liability on the part of the manufacturer, as contemplated by §402A.

The plaintiff in *Conner* v. *Dayton Rogers Manufacturing Co., supra,* was injured when a pneumatic die cushion failed to operate properly. Defendant argued that instructions given to keep the cushion greased were sufficient to exculpate them from liability. The court disagreed and found for the plaintiff:

> "Assuming inadequate greasing, however, it remains apparent that Dayton Rogers breached its duty to warn Wadsworth of the serious consequences of such an omission: the instruction manual supplied with the cushion merely advised that inadequate lubrication would result in dry seals and an attendant loss of pressure." 377 F.Supp. at 940.

The Court alluded to §402A and emphasized that:

> "The defendant's notification that inadequate lubrication would impair the efficiency of operation is not sufficient to inform Wadsworth of the true risks of such misuse." *Id.*

Northwest Airlines v. *Glenn L. Martin Company,* 224 F.2d 120 (6th Cir. 1955), is factually noteworthy to this Court's consideration of the within Motion for partial Summary Judgment on the issue of Liability. Northwest purchased several aircraft from defendant manufacturer

which had defective wing splices. Recovery was sought for the loss of one aircraft which crashed and the temporary loss of use of four others. The Court took note of the design defect resulting in metal fatigue:

> "It is known that a metal which is smooth and highly polished is less subject to fatigue than one with a rough finish or the surface of which is marred by a scratch or notch. A rough surface is a 'stress raiser'. Abrupt changes of section in the metal are also 'stress raisers', as are notches and bolt holes. It is stress concentration which is the fundamental cause of fatigue failure." *Id.* at 123, 124.

The Court found that the Trial Court had erred in instructing the jury as to assumption of the risk on the defendant's showing that an engineer and inspectors hired by the airline had observed the manufacture of the planes.

The holding in *Northwest Airlines* v. *Glenn L. Martin Company, supra,* clearly recognized that the duty of discovering the danger of a design defect rests with the manufacturer and the party to whom a duty is owed has a right to assume that it will be performed. *Id.* at 127. This is especially so in both *Northwest Airlines* v. *Glenn L. Martin Company, supra,* and the instant action where the source of the defect is fatigue failure at a critical point of stress. The technical knowledge and expertise involved in the production of an aircraft lies peculiarly within the province of the manufacturer. The *Northwest Airlines* v. *Glenn L. Martin Company, supra,* case was decided in the embryonic stages of manufacturer strict tort liability which has developed conceptually with the enlightened realization of

user reliance on the manufacturer's technical expertise. See also, *Vrooman* v. *Beech Aircraft Corp., supra.*

Point VIII

The Court May Consider Evidence Obtained in Discovery Proceedings on a Motion for Summary Judgment.

Fed. R. Civ. P. 56(c) allows this Court to consider evidence obtained during the course of discovery proceedings on this Motion for Summary Judgment. The pleadings, depositions, answers to interrogatories, admissions and supporting affidavits may be used to determine that there is no genuine issue of a material fact. There is great flexibility with regard to the evidence that may be used on a summary judgment motion. Evidence that would be admissible at a trial is equally admissible on a motion for summary judgment. *United States* v. *Gypsum Co.*, 340 U.S. 76 (1950); C. Wright & A. Miller, Federal Practice & Procedure §2721 (1973) [hereinafter referred to as Wright & Miller].

Evidence received during a deposition is especially valuable on a motion for summary judgment since the opportunity for cross examination is present:

> "Because a deposition is taken under oath and the deponent's responses are relatively spontaneous, it is one of the best forms of evidence for supporting or opposing a summary judgment motion." Wright & Miller §2722

Because of the inherent reliability of evidence produced at a deposition, it frequently serves as the basis for granting a motion for summary judgment. *S & S Logging Co.* v. *Barker*, 366 F.2d 617 (9th Cir. 1966); *Hoston* v. *J. R. Watkins Company*, 300 F.2d 869 (9th Cir. 1962).

As with the trial on the merits, where deposition testimony taken in another case is relevant to the subject matter in issue, such evidence is also admissible as the basis for granting summary judgment. *Occidental Fire & Casualty Co.* v. *Bartley*, 434 F.2d 55 (10th Cir. 1970); *MacKay* v. *American Potash and Chemical Company*, 268 F.2d 512 (9th Cir. 1959); *Western Land Corporation* v. *Crawford-Merz Company*, 62 F.R.D., 550 (D. Minn. 1973). In *MacKay* v. *American Potash and Company, supra*, the United States Court of Appeals for the Ninth Circuit dismissed the objections to the admissibility of such testimony by the plaintiff who made certain admission in a deposition in similar litigation, as without merit:

> "The application to perpetuate testimony and plaintiff's deposition were taken as a result of a claim of plaintiff which was substantially the same as the allegations contained in plaintiff's complaint in this case. While plaintiff objected to the use of the portions of the deposition contained in the affidavit, we find no merit to the objections. Clearly, admissions of a party relating to a material issue made under oath in deposition form may be considered in passing upon the motion for summary judgment." 268 F.2d at 515.

Thus, the testimony of Richard M. Morgan, Boeing's Service Department Chief, in litigation arising out of the crash of a military 707 (KC-135), meets the standards of admissibility for a motion for summary judgment. Not only was Boeing a party to that litigation, with all the

available benefits of cross examination of the deposition process to protect their interests, but specific reference was made to the subject crash of aircraft G-APFE. Moreover, the cause of the G-APFE crash was discussed extensively. See, *Western Land Corporation* v. *Crawford-Merz Company, supra,* 62 F.R.D. at 554; 6 MOORE'S FEDERAL PRACTICE, ¶56.11 [1-3] (2nd ed. 1976).

Likewise, Rule 56 specifically provides that answers to interrogatories may be used as a basis for summary judgment where the answers show that there is no genuine issue of material fact to be determined. *H.B. Zachry Company* v. *O'Brien,* 378 F.2d 423 (10th Cir. 1967); *Simmons* v. *Union News Company,* 341 F.2d 531 (6th Cir. 1965); *Sager Glove Corporation* v. *Aetna Insurance Company,* 317 F.2d 439 (7th Cir. 1963); *Schaefer* v. *Tannian,* 394 F.Supp. 1128 (E.D. Mich. 1974).

Evidence elicited at depositions and through document discovery that would be admissible at trial is available on a motion for summary judgment. *Wright & Miller, §2722.* The standards applied by the Federal Rules of Evidence R407, pertaining to the admissibility of evidence relating to subsequent remedial measures, allows introduction of such evidence to show the feasibility of precautionary measures.

The leading case of *Boeing Airplane Co.* v. *Brown,* 291 F.2d 310 (9th Cir. 1961), is cited in the Advisory Committee Notes to R407 as illustrative of this exception to the general rule precluding the admissibility of evidence of subsequent remedial measures. There, the admission of evidence showing that inherent design defects were corrected subsequent to the crash was affirmed.

The facts of the instant case fall precisely within the situation presented in *Boeing Airplane Co.* v. *Brown, supra.*

The admissions of Boeing engineers and representatives clearly show the practicability and feasibility of the design modification that was subsequently implemented on the 707 aircraft.

The testimony in the depositions further reveals that Boeing knew of this condition prior to the crash yet did nothing to correct the problem nor warn BOAC of the potential danger. The knowledge and information relating to the defect was peculiarly within the province of the Boeing engineers and representatives whose admissions show the defect as the cause of the crash. These admissions are properly considered as evidence at trial or supportive of a motion for summary judgment. F.R.E. 801(d)(2); *Grayson* v. *Williams,* 256 F.2d 61 (10th Cir. 1958); *Koninklijke Luchtvaart Maatschappij N.V. KLM* v. *Tuller,* 292 F.2d 775, 784 (D.C. Cir. 1961), *cert. denied,* 368 U.S. 921 (1961).

POINT IX

PLAINTIFF BOAC IS ENTITLED TO PARTIAL SUMMARY JUDGMENT ON THE ISSUE OF LIABILITY.

Rule 56 Fed. R. Civ. P. provides that a party may move for summary judgment where "there is no genuine issue as to any material fact" and therefore would be "entitled to a judgment as a matter of law." Where liability is shown as a matter of law, summary judgment is specifically allowed as to that issue even though an issue as to damages may still need to be adjudicated. It is the position of plaintiff BOAC that the instant action is a classic illustration where such bifurcated treatment is appropriate.

Memorandum in Support of Motion for Partial Summary Judgment

Under the law of Washington, governing the substantive issues herein, defendant Boeing is strictly liable in tort for the damages caused by the defective product (the Boeing 707 aircraft) which it manufactured. Evidence in support of the motion pursuant to Rule 56 and the Federal Rules of Evidence governing the procedural issues demonstrates that there is no genuine factual issue that aircraft C-APFE was defectively designed and manufactured and that these defects were the cause of the crash. *Hanna* v. *Plumer,* 380 U.S. 460 (1965).

Plaintiff makes this Motion for Partial Summary Judgment on the issue of liability based on the application of the strict tort liability concept, the effect of which is to relieve a plaintiff of the burden of proving that defendant is negligent. The elements of strict tort liability are appropriate for consideration on a motion for summary judgment since they lend themselves to a simple mechanical application of the admitted facts to the strict standard of liability. The facts herein clearly demonstrate that aircraft G-APFE was designed and manufactured defectively. Admissions by Boeing have established that this defect caused the fin terminal fitting and bulkhead to fail and that these inflight failures proximately caused the crash of G-APFE. Thus, plaintiff BOAC is entitled to summary judgment on the issue of liability as a matter of law. *See, American Airlines, Inc.* v. *Ulen,* 186 F.2d 529 (D.C. Cir. 1949), where summary judgment in a negligence action in favor of plaintiff was affirmed on the basis of written answers of interrogatories by defendant, which the Court found clearly established liability. Summary judgment has resulted where the facts elicited in depositions and in answers to interrogatories showed that the defendant had

Memorandum in Support of Motion for Partial Summary Judgment

struck plaintiff's stopped automobile. *Elasky* v. *Pennsylvania Railroad Company,* 215 F.Supp. 25 (N.D. Ohio 1962); *Baroff* v. *Becker,* 197 F.Supp. 9 (E.D.N.Y. 1961). *See also, Marsden* v. *Patane,* 380 F.2d 489 (5th Cir 1969); *Allen* v. *Southern Greyhound Lines, Inc.,* 270 F.Supp. 872 (E.D. La. 1967); *Block* v. *Biddle,* 36 F.R.D. 426 (W.D. Pa. 1965). Where uncontroverted admissions show that the fin terminal fitting of an aircraft is defective and causes its failure, a trial is likewise superfluous.

It should be noted that *American Airlines, Inc.* v. *Ulen,* supra, as well as all the other cases cited in the above paragraph involved liability grounded in negligence. Here, the standard for liability established in §402A dispenses with the need to show negligence.

Indeed, the limitations in a negligence case on a motion for summary judgment are obviated by §402A of the Restatement where the Court need only apply the pre-existing standard of strict tort liability to the admitted facts. Thus, in an action for injuries from impure food, plaintiff was not required to show negligence and partial summary judgment on the issue of liability was granted. *Belinsky* v. *Twentieth Restaurant, Inc.,* 207 F.Supp. 412 (S.D.N.Y. 1962). The showing that injury had occurred while eating food at defendant's restaurant was sufficient to sustain the motion.

The proof submitted herewith of the liability of defendant Boeing is not only irrefutable, but is, in all substantive aspects, a matter of judicial admission by Boeing. The facts demonstrate the liability of Boeing beyond any possible doubt. There is, demonstrably, no genuine issue of fact in this case. There is no reason why plaintiff BOAC should be obliged to go forward with extensive and expensive depositions of many witnesses when judicial ad-

missions and business records establish a conclusive case of liability against Boeing.

Certainly, the granting of the within motion would spare both BOAC and Boeing the time and expense of prolonged discovery and extensive trial. Significantly, the Court would be relieved of the unnecessary burden of trying this action, where liability of Boeing is clear beyond doubt, were the Court to grant the within motion of BOAC for Summary Judgment on the issue of liability.

Therefore, since the undisputed facts in the instant case show that the subject aircraft was defectively designed and manufactured and that the defect caused the crash and destruction of the aircraft, plaintiff BOAC is entitled to summary judgment as a matter of law.

Conclusion

By reason of each of the foregoing grounds, plaintiff British Overseas Airways Corporation respectfully submits that its Motion for Summary Judgment should be granted.

Respectfully submitted,

Bogle & Gates

By /s/ William L. Parker
William L. Parker

and

Condon & Forsyth

By /s/ Ronald E. Pace
Ronald E. Pace

Attorneys for Plaintiff
British Overseas Airways Corporation

Exhibit No. 1	Complaints of BOAC
Exhibit No. 2	Answers of Boeing
Exhibit No. 3	Answers of Boeing to BOAC's Interrogatories
Exhibit No. 4	Vertical Fin (Tail) Diagram
Exhibit No. 5	Deposition of Walter J. Hansen
Exhibit No. 6	Deposition of Richard M. Morgan
Exhibit No. 7	Deposition of H. Prater Hogue
Exhibit No. 8	Japanese Civil Aeronautics Board Accident Report
Exhibit No. 9	Deposition of Howard W. Smith
Exhibit No. 10	Wreckage Distribution Chart
Exhibit No. 11	Photo of Vertical Fin and Stabilizer
Exhibit No. 12	Deposition of Harold R. Zahn
Exhibit No. 13	Boeing Trajectory Analysis
Exhibit No. 14	Photo of Falling Aircraft Without Vertical Fin
Exhibit No. 15	Deposition of Richard M. Morgan (KC-135)
Exhibit No. 16	Deposition of Alvin C. Larsen
Exhibit No. 17	Deposition of James A. Ramsey
Exhibit No. 18	Boeing Metallurgical Report TC-3577

Memorandum in Support of Motion for Partial Summary Judgment

EXHIBIT No. 19	Boeing Alert Service Bulletin 2422
EXHIBIT No. 20	Deposition of H. Prater Hogue (KC-135)
EXHIBIT No. 21	Boeing Telex from Hogue to Vogwill
EXHIBIT No. 22	Boeing Specification 5440 Re: Machining Specifications
EXHIBIT No. 23	Letter from Vogwill to Folliard
EXHIBIT No. 24	Boeing Metals and Standards Group Metallurgical Examination MS 971
EXHIBIT No. 25	Boeing Metals and Standards Group Metallurgical Examination 6-7611 MS 988
EXHIBIT No. 26	Boeing Metals and Standards Group Engineering Report 6-7600 MS 955
EXHIBIT No. 27	Boeing Metals and Standards Group Engineering Report 6-7611 MS 946
EXHIBIT No. 28	Boeing Metals and Standards Group Engineering Report 6-7771 MS 853
EXHIBIT No. 29	Boeing Metals and Standards Group Engineering Report 6-7611 MS 1010

Memorandum in Support of Motion for Partial Summary Judgment

EXHIBIT No. 30	Boeing Inspection Records: G-APFE-1/28/66
EXHIBIT No. 31	Boeing Service Bulletin 1975 (R-2)
EXHIBIT No. 32	Deposition of Donald C. Knutson
EXHIBIT No. 33	Boeing 707-436 Flight Manual
EXHIBIT No. 34	Boeing Field Service Reports
EXHIBIT No. 35	BOAC Aircraft Special Check Form: G-APFE
EXHIBIT No. 36	Boeing Metals and Standards Group Fin Fitting Failure Analysis 6-7773 MS 146
EXHIBIT No. 37	Boeing Metals and Standards Group Coordination Sheet SU 717 B 443
EXHIBIT No. 38	Deposition of Thomas P. Enright (KC-135)
EXHIBIT No. 39	Boeing Metals and Standards Group Coordination Sheet 6-7741 52 53 C
EXHIBIT No. 40	Boeing Metals and Standards Group Coordination Sheet W 3011
EXHIBIT No. 41	Transcript of Tel/Con— Anderson/Morgan

Memorandum in Support of Motion for Partial Summary Judgment

EXHIBIT No. 42	Boeing Metals and Standards Group Engineering Report 6-7773 MS 497
EXHIBIT No. 43	Boeing Metals and Standards Group Engineering Report 6-7773 MS 526 R
EXHIBIT No. 44	Summary of Percentages of Fin Fitting Fractures
EXHIBIT No. 45	Significant 707, 720 and 727 in Service Problems
EXHIBIT No. 46	Letter of Greer Moore to United States Air Force 12/14/66
EXHIBIT No. 47	Letter of Greer Moore to United States Air Force 1/11/67
EXHIBIT No. 48	Work Description on Redesigned Fin Fitting dated 12/6/67

Notice of Motion For Summary Judgment

UNITED STATES DISTRICT COURT

WESTERN DISTRICT OF WASHINGTON

Nos. C74-257S and C74-380S

BRITISH OVERSEAS AIRWAYS CORPORATION,

Plaintiff,

vs.

THE BOEING COMPANY,

Defendant.

To: THE CLERK OF THE ABOVE-ENTITLED COURT, and BRITISH OVERSEAS AIRWAYS CORPORATION

PLEASE TAKE NOTICE that on August 27, 1976 at 9:30 A.M., or as soon thereafter as counsel may be heard, the undersigned will bring on for hearing before the Honorable Morell Sharp of this Court the defendant's Motion for Summary Judgment.

The Clerk is requested to note this motion on the motion docket for August 27, 1976.

DATED this 16th day of August, 1976.

PERKINS, COIE, STONE, OLSEN & WILLIAMS

By /s/ RICHARD C. COYLE
Richard C. Coyle
Attorneys for Defendant The Boeing Company

Notice of Motion For Summary Judgment

CERTIFICATE OF SERVICE

I hereby certify that on August 16, 1976 copies of the foregoing Notice of Motion for Summary Judgment, Motion for Summary Judgment and Memorandum were served upon the plaintiff by delivery to:

WILLIAM PARKER, ESQ.
BOGLE & BATES
The Bank of California Center
Seattle, Washington 98164

and mailing, postage prepaid to:

RONALD E. PACE, ESQ.
1251 Avenue of the Americas
New York, N. Y. 10020

/s/ RICHARD C. COYLE
Richard C. Coyle

Motion For Summary Judgment

UNITED STATES DISTRICT COURT

WESTERN DISTRICT OF WASHINGTON

Civil Nos. C74-380S and C74-257S

BRITISH OVERSEAS AIRWAYS CORPORATION,
Plaintiff,

vs.

THE BOEING COMPANY,
Defendant.

Defendant The Boeing by its undersigned attorneys, respectfully moves the Court, pursuant to Rule 56 of the Federal Rules of Civil Procedure, for summary judgment dismissing the complaint of plaintiff British Overseas Airways Corporation, granting to The Boeing Company its costs and attorneys' fees incurred in connection therewith and providing such further or other relief as the Court deems just. Said motion is made on the ground that there is no genuine issue of material fact and defendant is entitled to judgment as a matter of law.

Said motion will be based upon the attached Memorandum, the Appendix of Exhibits and the records and files herein.

DATED this 16th day of August, 1976.

PERKINS, COIE, STONE,
OLSEN & WILLIAMS

By /s/ RICHARD C. COYLE
Richard C. Coyle
Attorneys for Defendant
The Boeing Company

Appendix of Exhibits

Boeing Exhibit No. D-1	BOAC Incident/Accident Report No. 558, pp. i, 1-a, published in BOAC Air Safety Review August, 1967
Boeing Exhibit No. D-2	Minutes of BOAC Air Safety Committee for July 20, 1967
Boeing Exhibit No. D-3	Minutes of BOAC Air Safety Committee for April 20, 1966
Boeing Exhibit No. D-4	Article entitled "An Encounter with Extreme CAT" in *BOAC Air Safety Review* July, 1968
Boeing Exhibit No. D-5	IATA Incident and Accident Information Exchange Group Report No. 833
Boeing Exhibit No. D-6	F. H. Jones, "Note on the Accident to B.O.A.C. 707, G-APFE in Japan on 5th March 1966," Royal Aircraft Establishment Technical Report 66322
Boeing Exhibit No. D-7	Article entitled "Peel-Off Turbulence" in *BOAC Air Safety Review* December, 1970
Boeing Exhibit No. D-8	Affidavit of Howard W. Smith
Boeing Exhibit No. D-9	Affidavit of John D. Dillow, Esq.
Boeing Exhibit No. D-10	BOAC Preliminary Accident Investigation Report, Section 3 Technical Report, dated July 29, 1966

Boeing Exhibit No. D-1

BOAC Incident/Accident Report No. 558, pp. i, 1-a, published in BOAC Air Safety Review August, 1967

From: Chief Inspector of Accidents,
N103 Technical Block 'A',
London Airport.

To: See Distribution List

SKYPORT 5511 Extension 3058 14 July 1967

CONFIDENTIAL

AIRCRAFT INCIDENT/ACCIDENT REPORT No. 558

OBSERVATIONS, TRENDS etc:

The official report on the accident to G-APFE near Mount Fuji 5.3.66 was recently published by the Japanese. Therefore, included in this report is a summary of the investigation, together with extracts from the Japanese report.

The investigation was carried out by the Japanese in accordance with the Aircraft Accident Inquiry Procedure ICAO Annex 13 and Chief Inspector of Accidents, AIB/BOT was appointed the U.K. accredited representative. Chief Inspector's team was joined by the BOAC team and together they became known as the U.K. team. Also assisting were representatives and specialists from Boeing, Rolls Royce, FAA, CAB and RAE Farmborough. The joint Reconnaissance Intelligence Centre U.K. and the Meteorological Office Brecknell subsequently carried out studies on a cine film and weather data respectively.

Boeing Exhibit No. D-1

INDEX

TOTAL NUMBER OF INCIDENTS OUTSTANDING = 7

AIRCRAFT INCIDENT/ACCIDENT REPORT No. 558

ISSUED BY CHIEF INSPECTOR OF ACCIDENTS

CATEGORY 1—ACCIDENT

BOEING 707 AIRCRAFT

RR707/615 G-APFE—Tokyo/Hong Kong—5 March 1966
Flight/aircraft broke up in flight
Captain B J Dobson

From Report No. 543

Site of accident: 35°20′N, 138°49′E

Time of accident: 0516 GMT (1416 LT)

ALL TIMES IN THIS REPORT ARE GMT
(TOKYO TIME IS GMT + 9 HOURS)

Service Number: BA911/551

Boeing Exhibit No. D-1

Conditions: Day, clear, visibility 10 st. miles
Forecast surface wind 340°/15k.
Actual (as given by Tower)—surface wind 350°/22 k gusting to 25 k.
Wind at 14 000′ was reported to be 310°/60 to 72 k.

NATURE OF ACCIDENT

Shortly after take-off from Haneda Airport for Hong Kong, in daylight and in conditions of good visibility, the aircraft was seen to break up in the air and to fall on the eastern slopes of Mount Fuji. There was no fire prior to the break up but subsequently fire broke out in the forward part of the fuselage, which had broken away in the air. The crew of eleven and one hundred and thirteen passengers were killed. There were many witnesses to the accident and one witness who was on Mount Fuji filmed the final descent of the main part of the aircraft.

Reason Outstanding: awaiting publication of the Japanese Report.

CONCLUSION (extract from the Official Report)

"a) Results of Investigation

G-APFE was making a normal flight towards Mount Fuji till immediately before the accident in such clear weather that Mount Fuji could be seen from Tokyo.

The evidence provided by the aircraft wreckage, the injuries to the victims and the evidence from the colour film suggests that the aircraft suddenly encountered abnormally severe gust loads exceed-

ing the design limit load over Gotemba City and disintegrated in the air in a very short period of time.

Although it was impossible to forecast the existence over Gotemba City of turbulence sufficiently severe to destroy the aircraft and the investigation could not discover evidence which could verify meteorologically the existence of such turbulence, it cannot be denied that turbulence might have become extremely severe, if it is assumed that a strong mountain wave system was present in the lee of Mount Fuji.

b) Probable Cause.

The probable cause of the accident is that the aircraft suddenly encountered abnormally severe turbulence over Gotemba City which imposed a gust load considerably in excess of the design limit."

CIRCUMSTANCES OF ACCIDENT.

The aircraft departed London at 1757 hours on 1 March 1966 Service No. BA. 509 and arrived at New York 0142 hours 2 March 1966. It departed New York at 2003 hours 2 March 1966 on Service No. BA. 911 and called at San Francisco and Honolulu. The aircraft departed Honolulu at 2245 hours 3 March 1966 under the command of the Captain involved in the accident who was scheduled to fly the sectors Honolulu/Tokyo/Hong Kong.

The calculated time of arrival of the aircraft at Tokyo was 0745 hours on 4 March. At 0700 hours the BOAC Duty Officer at Haneda Airport Tokyo, contacted the aircraft

on the BOAC VHF frequency of 131.7 mc/s and informed the Captain that the precision approach radar of the GCA at Haneda was out of service. The actual Haneda weather at that time (0700 hours) was:—surface wind 040/3 knots, visibility three quarters of a mile, weather fog, cloud 3/8 at 200 feet, temperature +14°C, dew point +13°C. Because of the poor visibility and the unserviceability of the GCA the Captain decided to divert to Itazuke, where better weather conditions prevailed and the aircraft landed there at 0900 hours 4 March 1966.

At Itazuke the aircraft was refueled with JPI and following an overnight stop G-APFE departed Itazuke at 0225 hours 5 March 1966. It arrived at Haneda at 0349 hours. The transit time at Haneda was one hour one minute and during this time the Captain was briefed by an Operations Assistant.

The IFR flight plan which was filed with the JCAB gave Oshima, Rebel and Kagoshima as the first three on-route points for the flight to Hong Kong. Other information included on the flight plan was a cruising level of FL 310, an estimated flight time of four hours seventeen minutes and fuel endurance of five hours and thirty five minutes.

The aircraft was fueled with JPI to a total of 43 570 kg which included 600 kg for taxying; all wing tanks were full and there were 2 570 kg in the centre tank. The commercial load included 113 passengers, baggage, mail and freight; there were four flight deck crew and seven cabin staff. The aircraft's take off weight was calculated as 117 832 kg (KTOW 129 500 kg), the laden index as +190 and the stabliliser setting for take off as 1¾ divisions 'aircraft nose up'.

Boeing Exhibit No. D-1

The BOAC Station Engineer Haneda, has reported that a routine transit check was carried out on the aircraft and no defect was found, nor was any defect reported in the aircraft's sector defects log for the flight from Itazuke to Tokyo. The Station Engineer noted that on departure from Haneda Captain Dobson occupied the left hand pilot's seat.

The passengers commenced boarding at 0433 hours and the aircraft called Tokyo ground control on the VHF frequency of 121.7 mc/s.

Communications between the aircraft and Tokyo ground control/tower included the following transmissions:—

"aircraft—nine one one we are IFR to Hong Kong requesting to start engines five minutes that VMC climb via Fuji Rebel Kushimoto"

The ground control gave permission to start engines; later the aircraft was cleared to taxi to runway 33L and left the tarmac at 0450 hours.

"aircraft—Tokyo Speedbird nine one one standing by clearance

control —Speedbird nine eleven are you VMC departure is that correct

aircraft—We VMC ás far as Rebel Kushimoto via Fuji IFR to Hong Kong

control —Roger contact Tokyo en route for ATC clearance over

aircraft—Roger understand Speedbird nine eleven is cleared for VMC climb to en route contact ATC en route

Boeing Exhibit No. D-1

aircraft—Speedbird nine one one we are cleared to tower frequency

control —This time contact tower one one eight one . . ."

On arrival at Runway 33L the aircraft was cleared by Tokyo tower for an immediate take off with a right turn out and was airborne at 0458 hours.

"aircraft—Tokyo tower Speedbird nine eleven we are two thousand feet climbing are we cleared your frequency

tower —Roger Speedbird nine eleven airborne at five eight cleared to leave our frequency contact Tokyo control approaching joining airway over

aircraft—Will do frequency please

tower —Roger frequency will be one three five point niner over

aircraft—Roger one three five nine good day . . ."

This was the last transmission received from the aircraft. Analysis of available eye witness evidence indicates that the first sign of trouble was when the aircraft was about six kilometres west of Gotemba, a small town at the foot of the eastern slopes of Mount Fuji. It is about 80 kilometres west of Haneda Airport and about twenty kilometres from the summit of Fuji. At this time "white smoke" was seen to be coming from both wing tips and within seconds of this occurrence parts of the aircraft were seen to break away. There are reports that part of the starboard wing, the empennage and the forward fuselage all broke away in the air and in fact these parts did so break away.

Boeing Exhibit No. D-1

The main piece of wreckage included all the port wing, the starboard wing to inboard of No. 4 engine and the fuselage from stn 600k (leading edge of wing) to stn 1505 (fin rear attachment) and this fell almost vertically on to the wooded slopes of Fuji near an observation station at Tarobo, about 12 kilometres west of Gotemba. The forward part of the fuselage fell about 350 metres ahead and to the left of the main wreckage and the engines fell one to two kilometres ahead. The starboard outer wing broke into two main pieces and fell two to three kilometres before the main wreckage as did the fin, horizontal stabilisers and rearmost pieces of the fuselage. Smaller and lighter pieces of aircraft structure and passenger property were scattered for a distance of about 15 kilometres before the main wreckage.

Extract from the Official Report:

"The estimated flight path from Tokyo International Airport to Gotemba City, based on an 8 millimetre cine colour film of the countryside taken by a passenger on board, is as follows:

The aircraft, after taking off from Tokyo International Airport, flew over Samezu, made a right turn and proceeded, climbing, towards a point between Tokohama and Ofuna. It then made another right turn and flew over a point approximately 13 kilometres to the north west of Odawara City and approximately 5 kilometres to the north of Mount Myojindako at an altitude of 5 100 metres on a heading of approximately 246°M at an indicated airspeed of 320 to 370 knots. The aircraft subsequently flew over Gotemba City on a heading of approximately

Boeing Exhibit No. D-1

298°M at an altitude of approximately 4 900 metres and indicated airspeed of 320 to 370 knots.

(Immediately after this, the film skipped two frames, followed by vague pictures of something like the passenger seats or cabin carpet, and suddenly came to an end).

The estimated flight path from Gotemba City to the crash site, based on the statements of many witnesses and the pictures is as follows:—

The aircraft, trailing white vapour, was losing altitude over the Takigahara area, and parts of the aircraft began to break away over Tsuchiyadai and Ichirimatsu.

Finally over Taroba at an altitude of approximately 2 000 metres, the forward fuselage broke away. The mid-aft fuselage together with the wing, making a slow flat spin to the right, crashed into a forest at 2109 Nakahata, Gotemba City at approximately 0515 hours

The forward fuselage crashed into the forest approximately 300 metres to the west of the above site and caught fire."

Notification of an aircraft accident was first made to the Gotemba police at 0515 hours. The police checked via the prefectural headquarters the movements of aircraft in the area and were told there had been no aircraft flying near Mount Fuji. Nevertheless the Gotemba police decided to investigate the accident report and at about 0645 hours the police station was advised from the crash site that the wrecked aircraft was a BOAC Boeing 707. The

Gotemba police quickly organised a large scale emergency force and some 300 personnel and equipment was brought to the scene.

By 1500 hours, all the victims had been removed from the area and taken to nearby Buddhist temples.

Post-mortem examinations of the flight crew members revealed no evidence of any pre-existing disease or drugs that might have affected the performance of their duties.

EXAMINATION OF THE AIRCRAFT WRECKAGE.

The field examination of the wreckage included a preliminary examination of all the in-flight fractures by a Boeing metallurgist. He considered that all the fractures were of an overload type but in the case of the fin right rear fuselage fitting the fracture face included two small areas of fatigue one at each side of the top outboard bolt hole.

The fin fitting was released to Boeing for detailed metallurgical examination and they concluded that these cracks were not an accident cause factor.

The wreckage was subsequently taken to a hanger at Chofu airfield for further examination.

The analysis of the wreckage is as follows:

Extract from the Official Report:

> "The starboard wing fractured at STA 733 and in the vicinity of STA 550; both fractures were in the direction of wing tip up bending.
>
> All the pylons fractured at their wing attachments in the same manner, due to predominantly leftward load.

The forward fuselage failed to the left (and slightly downward) in the vicinity of STA 600K.

The aft fuselage fractured in the area between STA 1440 and STA 1592. The ventral fin fractured at its fuselage attachment section due to approximately leftward load and broke away from the fuselage.

The vertical stabilizer fractured at its attachment to the fuselage due to leftward load. The starboard rear attachment fitting (on fuselage side) of the vertical stabilizer fractured at the upper bolt hole due to tension load. Fatigue cracks were found on the fracture face of one of the bolt holes.

Damage to the port horizontal stabilizer was extensive and dents, scratches and paint adhesion were found which are presumed to have been caused by it being struck by the vertical stabilizer. Subsequently the port horizontal stabilizer separated from the fuselage at its root.

The starboard horizontal stabilizer, which was almost intact, broke away from the fuselage together with the centre section. The jack screw rod of the horizontal stabilizer trim actuator fractured near the top end at the lower surface of the nut. The length of the screw from the stopper surface of the upper part of the screw and the upper surface of the nut was 105 mm corresponding to 1.4 units aircraft nose down on the pitch trim wheel scale in the cockpit.

Almost all instruments were destroyed by the fire in the forward fuselage and no useful data were available.

It is presumed that the aircraft was in cruising configuration because the flaps and the landing gear had been in the retracted position.

No structural defects were found in the airframe structure except the fatigue cracks in the vertical stabilizer rear spar attachment fitting.

No sign of malfunctioning was evident in the flying control systems, control surfaces and other systems.

There was no evidence of any pre-crash engine defects. No sign of explosion in the cabin was found.

Fire broke out in the forward fuselage at ground impact. It is presumed that a considerable amount of fuel entered the space below the forward fuselage floor as a result of the break up of the centre wing front spar, which took place when the forward fuselage broke in the air at STA 600K, and the damage to the centre fuselage fuel tank which appears to have occurred at the same time. None of the wreckage other than the forward fuselage caught fire.

Load and Strength of Airframe Structure

Based on the data submitted by the Boeing Company the strength of the airframe structure was investigated in accordance with airworthiness requirements (CAR 4b) of the Civil Aviation Regulations, United States. For this analysis, it was assumed that the aircraft weight was 112 500 kilogrammes (252,000 pounds) and the airspeed 335 knots, EAS. The principal results were as follows:

i) The strength of the wing around STA 733 corresponds to a symmetrical lead of 6.4g and, in

the case of about 10° side slip, the wing load amounts to approximately 4.6g.

ii) The strength of the fuselage around STA 600K is 5.6g downward and 4.1g sideward and that of the pylon attachment portion is 2.75g (inboard)—2.55g (outboard) sideward. Any of the above areas can stand a steady side slip in excess of 40°.

iii) a) The strength of the vertical fin for lateral load corresponds to the load which will be produced by lateral gust velocity (U_{de}) of 130 fps (75 kt) EAS or by side slip of 10°.

b) The horizontal stabilizer was designed for an ultimate distributed air load of 140,000 lb (margin of safety factor is approximately 0.15). This load corresponds to the load which will be produced by a downward gust velocity (U_{de}) of 225 fps (133 kt) EAS approximately."

Engines

Nos. 1, 2 and 4 engines were found about 1 km ahead of the main wreckage and No. 3 engine nearly 2 kms ahead of the main wreckage.

There was no evidence of fire and the condition of the rotating assemblies indicated that these had almost stopped at the time of impact with the ground. There had been no in-flight breack-up of the turbines or compressors.

The fractures of the engine mountings indicated that the engines had all broken away to the left and downwards.

No. 3 engine had lost its side cowling and there was evidence that this engine had struck the wing leading edge

just inboard of its position. Pieces of No. 3 engine cowling were found along the wreckage trail.

METEOROLOGICAL INFORMATION

Extract from the Official Report:

"a) Meteorological Conditions between Tokyo and Mount Fuji.

A depression intensified during the night of 4th/5th March and moved rapidly NE across Japan. After this, there was an anticyclone over the Asian Continent and a depression over the sea to the east of Japan; a steep pressure gradient from west to east predominated over Japan at low levels.

On the afternoon of 5th March, westerly or north-westerly winds blow at the surface between Tokyo and Gotemba, the weather being fine with such good visibility that, quite unlike the previous day, Mount Fuji could be seen from Tokyo. At higher levels, the winds were generally west-north-westerly between Tokyo and the Mount Fuji area. According to the observations taken at the Fuji-san Weather Station (elevation 3,776 metres) at the summit of Mount Fuji, the wind was 60 to 70 knots north-west and the temperature was —9 to —12°C.

b) Turbulence Reports from Aircraft

Air reports were collected from 100 aircraft which flew within 150 kilometre radius of Mount Fuji on 5th March. 79 aircraft among the 100 aircraft experienced turbulence, mostly below 3,000 metres, and principally at low altitude during climb or

descent. 4 aircraft out of the 79 encountered severe turbulence within a 50 kilometre radius of Mount Fuji in its eastern quadrant.

c) Meteorological Service to G-APFE

The Tokyo Aviation Weather Service furnished the BOAC Operations personnel on duty with the prescribed weather charts regarding the G-APFE flight between Tokyo and Hong Kong. . ."

The meteorological information collected during the investigation was analysed by the Meteorological Office, Bracknell and they also obtained the photograph which was taken by the weather satellite ¾ hr. before the accident.

An extract from their conclusions is as follows: —

"A strong mountain wave situation existed over Honshu on 5 March 1966. Wave clouds were detected by satellite ¾ hour before accident time to west and southwest of Fuji; the lack of wave clouds over Central Honshu is attributed to very dry air following the passage of the WNW airstream over the Japanese Alps. The wavelength of lee waves is estimated at around 13 miles and there is considerable support for a case of wave resonance to the lee of Fujisan with the possibility of a rotor, in the vicinity of Gotemba where the accident is thought to have occurred. The precise effects of a conical mountain, such as Fujisan, on a system of waves set off by the Japanese Alps are not known but theory suggests that a first lee-wave of considerable amplitude could have existed. US Meteorologists, serving in the Tokyo area, with ex-

perience of the peculiarities of Fujisan considered the situation favourable for strong turbulence to lee of the mountain and also issued a CAT warning for levels below 12000 ft over eastern Honshu on the 5th about 4 hours prior to the accident. The main point of doubt is whether severe turbulence could have been associated with the lee wave system near Gotemba at 14,000-13,000 ft. . . ."

Aircraft History

The aircraft, Serial No. 17706, was built in 1960; its Certificate of Airworthiness was valid until 28th April 1966.

At the time of the accident the aircraft had flown 19524 hours and completed 6744 landings. The date of the last Certificate of Maintenance which was issued following a B6 was 28 Jan 1966. Aircraft hours at time of issue were 19119. Period of validity—60 days or 600 hours whichever occurs soonest.

Crew Licences

All crew licences were in order.

Action

Resulting from the discovery of the fatigue cracks in the fin attachement fitting, a world wide inspection was carried out on all 707 aircraft. Most airlines found that on some of their aircraft they had cracked fittings. On six of the 19 remaining BOAC 707 aircraft 10 fittings were found cracked. All cracks were in excess of the rework limit so the fittings were changed. On four of these aircraft both rear fittings were cracked.

In August 1966 Boeing issued Service Bulletin 2422 to introduce stronger fittings and to reinforce the bulkhead to which they are attached. All BOAC aircraft are now modified.

Recommended Closed.

Boeing Exhibit No. D-2

(Minutes of BOAC Air Safety Committee for July 20, 1967)

BOAC AIR SAFETY COMMITTEE

MINUTES OF THE MEETING HELD ON 20 JULY 1967

Present:

Chairman:	Mr A C Norman	Member of the Board
	Mr D Craig	Senior General Manager
Secretary:	Mr R O Belton	Flight Safety Officer
Also present:	Mr J G Boulding	Chief Inspector of Accidents
For Minute No 752:	Mr D P Harrison	Art Editor Advertising Branch

ACTION

751 The minutes (and attachment) of the meeting held on 23 June 1967 were approved.

752 MATTERS ARISING FROM PREVIOUS MINUTES

Safety Leaflet Improvements (PM735.3)

Art Editor briefly reviewed the events which had led up to the present situation. He had discussed the matter of a full pictorial presentation with Mr Kinnear who had indicated that redundancy was necessary and both words and pictures would be required. Art Editor then presented two proposals —one in paper, one in plastic—for consideration. The Committee pointed out that, from the safety point of view, it was necessary that the leaflet

should be readily available, clearly visible and simple to read. The present method of showing the leaflet inside an envelope in the flight guide, did not meet these requirements. After discussion, Art Editor agreed to take his proposals to the Customer Services Committee, and present the views of the Air Safety Committee.

The Committee agreed that the final decision on materials used would be that of the CSC. All it wished to ensure was that the leaflet should be stowed separately in the seat back pocket and be large enough to be seen.

ART EDITOR

753 INCIDENT/ACCIDENT REPORT No 558

.1 RR707/615 Flight/aircraft broke up in flight.

The Committee thanked Chief Inspector of Accidents for this very clear and concise report on this accident. It was noted that the cause of the accident was abnormally severe CAT which imposed excessive loads on the aircraft—beyond its design limits. Action taken over the years to inform all staff of the problems of turbulence was noted.

.2 RR707 / 772 Flight / Nose gear defect / Aircraft landed with nose gear retracted.

The Committee noted that the cause of this accident was the incorrect fitting of the centralising cam keys. Failure of communication was also apparent when the reported defects of the leg are considered.

Improvements in documentation are being implemented and should take effect in the autumn. It

was hoped that this would have the effect of improving the awareness necessary to ensure that early action is taken. The Committee congratulated the crew on the excellent way in which they handled the emergency.

.3 VC10/344 Ground/Brake system defect.

In considering this incident the Committee remarked that this was caused by bad co-operation, poor workmanship and the failure to follow laid down procedures.
It was hoped that the improved documentation system mentioned above will prevent this type of incident recurring.

.4 SVC10/275 Ground/Flying control system defect.
In discussing this incident the Committee could not understand how such a large item was not found during a previous control run check. The Committee noted that there had been reports of "foreign objects" which had been found in our aircraft at various times. It noted that GMMce was taking positive action to try to prevent these from causing damage by eliminating them at source but that this was an extremely difficult problem. It seemed to the Committee that a higher level of "professionalism" in all Maintenance staff was called for and hoped that the training programme outlined by CE during his recent visit, would cover this point. The Committee expressed its concern over this problem and asked to be kept informed of action taken to overcome it.

CE

.5 SVC10/292 Flight/pressurisation system defect.

The Committee was informed that it had been thought that the discharge valve would fail safe. It had not been appreciated that this depended upon the pad valve remaining open. Action has been taken and a modification is in hand to ensure the valve can be closed when required.

754 AIRMISSES

AM Lahore 1, AM France 28, AM New York 47 and AM New York 48 were considered.

755 FLIGHT SAFETY OFFICER'S MONTHLY REPORT

Engine Icing
The Committee noted the incident to another operator's VC10. It was assured that both Flights had taken appropriate action in the light of the information presently available.

756 OTHER CIVIL AIRLINES INCIDENTS AND ACCIDENTS

The list provided and additional information was considered.

757 DATE OF NEXT MEETING

The date of the next meeting was confirmed as:—
Friday 22 September at 1430 in Conference Room Z023, Ground Floor Speedbird House.

Boeing Exhibit No. D-3

(Minutes of BOAC Air Safety Committee for April 20, 1966)

BOAC AIR SAFETY COMMITTEE

MINUTES OF THE MEETING HELD ON 20 APRIL 1966

Present:

Chairman:	Mr B S Shenstone	Technical Director
Secretary:	Mr R O Belton	Flight Safety Officer
Also present:	Mr J Boulding	Deputy Chief Inspector of Accidents

Mr D Craig was unable to attend.

ACTION

628 The minutes of the meeting held on 22 March 1966 were approved.

629 MATTERS ARISING FROM PREVIOUS MINUTES

629.1 Carriage of Distress Beacons (PM606.1, 598.1, 557)

The Committee noted that the MoA had been requested to approve the number of two of the new distress beacons per aircraft. It was suggested however that in view of the possible advent of "Jumbo" jets it might be better to suggest that this is amended to one emergency radio beacon per 100 persons capacity.

FSO

629.2 Maintenance Problems Raised by SVC10/55—Stall Protection System Defect (PM621.1, 614.1)

Boeing Exhibit No. D-3

Failure to follow laid down drill or procedure (PM621.2, 615.2)

Ground Incidents (PM621.2, 615.7)

VC10/200 Airframe de-icing system defect (PM622.11)

The Committee noted that suitable action had been taken in respect of each of these incidents.

629.3 Use of Radio Active Material to Assist in Locating Flight Recorder

The Committee requested that MDM should press forward with this suggestion and asked for a report at a future meeting.

FSO

630 INCIDENT/ACCIDENT REPORT No. 543

630.1 RR707/615 Accident to G-APFE

The report on the facts surrounding this accident prepared by DCIA was considered. The Committee noted that the investigation is continuing and that all possible professional help available is being used to attempt to establish the cause of the accident. The Committee requested to be kept up-to-date with developments as they occurred.

CIA

630.2 PW707/05 Ground/Cargo Insecure

The Committee noted that this incident could have had serious consequences. DCIA reported on the action which had been taken by Traffic

Manager and this was approved by the Committee.

630.3 VC10/225 Flight/Engine Flame-out/Refueling Defect/Instrumentation Defect

The Committee noted that this incident had occurred due to a series of circumstances and the fact that the refueler did not appreciate the significance of the initial fuel figure as part of the final crosscheck. It was hoped that the facts of this incident will be made well known amongst all staff of all stations so that a similar occurrence could not take place.

630.4 VC10/207 and 215 Flight/Flying Control System Defect (Asymmetric Operation of Spoilers) DCIA reported that an additional incident had occurred since the report had been prepared. The Committee noted that the Flight had issued a notice (57/66) which drew the attention of flying staff to the problem and that a modification programme was in hand.

630.5 VC10/197/Flight/Nosewheel Tyre Defect

In noting this incident the Committee remarked that the Captain had continued the flight knowing that there had been a tyre failure during take-off at Rome not knowing what damage had been done to the aircraft. In view of previous experience where damage to aircraft had occurred DCIA was requested to enquire of the Captain his reason for continuing the flight to Nairobi.

DCIA

630.6 VC10/228/Flight Landing Gear System Defect

The Committee noted that this was a case of fatigue failure. DCIA reported that a special check was being carried out on all fittings.

630.7 VC10/216 Flight/Abandoned Take-off/Airspeed Indicator System Defect

The Committee remarked this appeared to be a matter of bad design. DCIA indicated that the manufacturer is studying the problem and a modification is expected in the near future.

630.8 SVC10/Ground/Brake System Defect

The Committee remarked on the seriousness of this type of failure and that again this appeared to be a matter of design fault. Although there were two separate systems and separate means for operating the brakes both are commoned at the brake control valve. This appeared to be a severe weakness of the system. The modification was noted but the Committee felt that in the long term consideration might well be given to fitting dual control valves so that the control of the system is genuinely split.

CIA

630.9 Ground Incidents

The Committee remarked once again that all the ground incidents reported had been caused by carelessness in some form or another. The two incidents which related to the VC10 catering bridge were particular examples. The bridge had been introduced in order to avoid damage by catering vehicles in the confined

space between the trailing edge of the wings and the engines. It now appears that careless use of the catering bridge is causing almost as much damage as it was designed to save.

631 AIRMISSES

AM Lod 1 was noted.

AM London 42. The Committee accepted that this incident should be regarded as closed but requested that FSM should report from time to time on progress being made by the Ministry in their attempts to avoid similar occurrences.

FSM
ACTION

632 FLIGHT SAFETY OFFICER'S MONTHLY REPORT

632.1 Convair Studying System for In-Flight Recording of Turbulence.
ICAO Analyses
ICAO 5th Air Navigation Conference

The Committee noted the information contained in the report on these three items and asked to be kept informed of progress.

FSO

632.2 The Cost of Safety

The article from a recent copy of AeCan was noted and the suggestion made in it that pilot information was often over-ridden on matters of safety. The Committee expressed the view that the greatest assistance that pilots could make towards improving safety would be the reporting of near incidents and accidents so that the implications of such occurrences could

be investigated and action taken which could perhaps prevent an accident occurring.

632.3 Flight Safety Literature was noted.

633 OTHER CIVIL AIRLINES INCIDENTS AND ACCIDENTS

The list was noted.

634 The dates of the next meetings were confirmed as

Preparatory meeting	17 May 1966
Committee meeting	24 May 1966.

Boeing Exhibit No. D-4

(Article entitled "An Encounter with Extreme CAT" in *BOAC Air Safety Review* July, 1968)

SAFETY DIGEST

Two items from United Air Lines' "The Cockpit"

AN ENCOUNTER WITH EXTREME CAT

In March 1966, a BOAC 707 was destroyed in the air by an extreme mountain wave generated by Mt Fuji outside of Tokyo. The following excerpt from a personal account of an experience with the same turbulence pattern by one of United Air Lines' new pilots should be of interest to all flight officers as a reminder of how violent mountain waves can be under the right set of conditions.

"March 5th, 1966 was a beautiful, sunny, cloudless day, with a brisk north wind blowing. I was preparing to take off during the early afternoon from NAS Atsugi (30 miles from Tokyo) on a routine test flight from the Navy Overhaul and Repair facility there, when Atsugi tower asked if I would investigate a report of a crash south of Mount Fuji. I took off, and from 30 miles away could see a plume of dense black smoke rising, perhaps to 8000 feet. My aircraft, an A-4C was fully loaded with fuel (gross weight 22,000) but nevertheless was highly maneuverable. As I neared the crash site, I descended from 11,000 ft. MSL to 5000 ft. AGL and immediately—like running into a brick wall—was tossed about so violently that I was unable to read any instruments and had my hands completely full trying to keep my airplane upright. One fitting of my oxygen mask was shaken loose and as my head was

banging back and forth off the canopy, the brilliant thought entered my mind that I should get the h - - - outta there. Somehow I managed to keep the nose pointed more up than down and eventually climbed to 16,000 ft. MSL, all the time being batted around by the turbulence in the lee of Mount Fuji. From the comparative calm of that altitude, I directed the rescue helicopter toward the crash but the turbulence was too great even for him to get within 5 miles of the scene.

". . . As a sidelight, I was first on the scene, about 7 minutes after impact, and later reports from ground rescue parties said that it was possible that winds as high as *90 MPH could have existed around Fuji's summit, 12,388 feet high. The official report as published in Encyclopedia Britannica states that the 707 'broke up 3000 ft. above the summit' **, and plunged to earth on the east slope, below the timberline. That would have placed him only 500 below my final altitude of 16,000. I was thankful that the A-4C withstood the recorded accelerometer readings—in excess of *positive 9* and *negative 3* 'Gs' ".

*Wind measurements atop Mt. Fuji were officially recorded up to 70 knots (80 MPH). Higher winds in the turbulent zone would have been highly probable.

**A Japanese accident report established the aircraft breakup point as 16,000 feet at a distance of 10-½ miles southeast of the Mt. Fuji summit. These findings also indicated that aircraft stresses on the 707 exceeded 8 Gs.

Boeing Exhibit No. D-5

(IATA Incident and Accident Information Exchange Group Report No. 833)

No. 833

INCIDENT AND ACCIDENT INFORMATION EXCHANGE GROUP
(STRICTLY CONFIDENTIAL: Only to be used by aircraft operators for accident prevention)

FROM : NS

Boeing 707—Tokyo/Hong Kong—5 March 1966
Flight/aircraft broke up in flight

Site of accident: 35°20′N, 138°49′E

Time of accident: 0516 GMT (1416 LT)

ALL TIMES IN THIS REPORT ARE GMT
(TOKYO TIME IS GMT + 9 HOURS)

Conditions: Day, clear, visibility 10 st. miles
Forecast surface wind 340°/15 k.
Actual (as given by Tower)—surface wind 350°/22 k gusting to 25 k.
Wind at 14 000′ was reported to be 310°/60 to 72 k.

NATURE OF ACCIDENT.

1. Shortly after take-off from Haneda Airport for Hong Kong, in daylight and in conditions of good visibility, the aircraft was seen to break up in the air and to fall on the eastern slopes of Mount Fuji. There was no fire prior to the break up but subsequently fire broke out in the forward part of the fuselage, which had broken away in the air. The crew of eleven and one

hundred and thirteen passengers were killed. There were many witnesses to the accident and one witness who was on Mount Fuji filmed the final descent of the main part of the aircraft.

CONCLUSIONS (extract from the Official Report)

2. "a) Results of Investigation

The aircraft was making a normal flight towards Mount Fuji till immediately before the accident in such clear weather that Mount Fuji could be seen from Tokyo.

The evidence provided by the aircraft wreckage, the injuries to the victims and the evidence from the colour film suggests that the aircraft suddenly encountered abnormally severe gust loads exceeding the design limit load over Gotemba City and disintegrated in the air in a very short period of time.

Although it was impossible to forecast the existence over Gotemba City of turbulence sufficiently severe to destroy the aircraft and the investigation could not discover evidence which could verify meteorologically the existence of such turbulence, it cannot be denied that turbulence might have become extremely severe, if it is assumed that a strong mountain wave system was present in the lee of Mount Fuji.

b) Probable Cause.

The probable cause of the accident is that the aircraft suddenly encountered abnormally severe tur-

bulence over Gotemba City which imposed a gust load considerably in excess of the design limit."

CIRCUMSTANCES OF ACCIDENT

3. The aircraft departed London at 1757 hours on 1 March 1966 and arrived at New York 0142 hours 2 March 1966. It departed New York at 2005 hours 2 March and called at San Francisco and Honolulu. The aircraft departed Honolulu at 2245 hours 3 March 1966 under the command of the Captain involved in the accident who was scheduled to fly the sectors Honolulu/Tokyo/Hong Kong.

4. The calculated time of arrival of the aircraft at Tokyo was 0745 hours on 4 March. At 0700 hours the Duty Officer at Haneda Airport Tokyo, contacted the aircraft on the Company VHF frequency of 131.7 mc/s and informed the Captain that the precision approach radar of the GCA at Haneda was out of service. The actual Haneda weather at that time (0700 hours) was: —surface wind 040/3 knots, visibility three quarters of a mile, weather fog, cloud 8/8 at 200 feet, temperature + 14°C, dew point + 13°C. Because of the poor visibility and the unserviceability of the GCA the Captain decided to divert to Itazuke, where better weather conditions prevailed and the aircraft landed there at 0900 hours 4 March 1966.

5. At Itazuke the aircraft was refueled with JPI and following an overnight stop departed Itazuke at 0225 hours 5 March 1966. It arrived at Haneda at 0349 hours. The transit time at Haneda was one hour one

minute and during this time the Captain was briefed by an Operations Assistant.

6. The IFR flight plan which was filed with the JCAB gave Oshima, Rebel and Kagoshima as the first three en route points for the flight to Hong Kong. Other information included on the flight plan was a cruising level of FL 310, an estimated flight time of four hours seventeen minutes and fuel endurance of five hours and thirty-five minutes.

7. The aircraft was fueled with JPI to a total of 43 570 kg which included 600 kg for taxying; all wing tanks were full and there were 2 570 kg in the centre tank. The commercial load included 113 passengers, baggage, mail and freight; there were four flight deck crew and seven cabin staff. The aircraft's take-off weight was calculated as 117 832 kg (RTOW 129 500 kg), the laden index as ÷190 and the stabiliser setting for take-off is 1¾ divisions 'aircraft nose up'.

8. The Station Engineer Haneda, has reported that a routine transit check was carried out on the aircraft and no defect was found, nor was any defect reported in the aircraft's sector defects log for the flight from Itazuke to Tokyo. The Station Engineer noted that on departure from Haneda the Captain occupied the left hand pilot's seat.

9. The passengers commenced boarding at 0433 hours and the aircraft called Tokyo ground control on the VHF frequency of 121.7 mc/s.

Boeing Exhibit No. D-5

10. Communications between the aircraft and Tokyo ground control/tower included following transmissions: —

"aircraft . . nine one one we are IFR to Hong Kong requesting to start engines five minutes that VMC climb via Fuji Rebel Kushimoto"

11. The ground control gave permission to start engines; later the aircraft cleared to taxi to runway 33L and 1 ft the tarmac at 0450 hours.

"aircraft . . Tokyo nine one one standing by clearance

control . . nine eleven are you VMC departure is that correct

aircraft . . We are VMC as far as Rebel Kushimoto via Fuji IFR to Hong Kong

control . . Roger contact Tokyo en route for ATC clearance over

aircraft . . Roger understand nine eleven is cleared for VMC climb to en route contact ATC en route

aircraft . . nine one one we are cleared to tower frequency

control . . This time contact tower one one eight one. . ."

12. On arrival at Runway 33L the aircraft was cleared by Tokyo tower for an immediate take off with a right turn out and was airborne at 0458 hours.

Boeing Exhibit No. D-5

"aircraft . . Tokyo tower nine eleven we are two thousand feet climbing are we cleared your frequency

tower . . Roger nine eleven airborne at five eight cleared to leave our frequency contact Tokyo control approaching joining airway over

aircraft . . Will do frequency please

tower . . Roger frequency will be one three five five point nine over

aircraft . . Roger one three five nine good day. . ."

This was the last transmission received from the aircraft.

13. Analysis of available eye witness evidence indicates that the first sign of trouble was when the aircraft was about six kilometres west of Gotemba, a small town at the foot of the eastern slopes of Mount Fuji. It is about 80 kilometres west of Haneda Airport and about twenty kilometres from the summit of Fuji. At this time "white smoke" was seen to be coming from both wing tips and within seconds of this occurrence parts of the aircraft were seen to break away. There are reports that part of the starboard wing, the empennage and the forward fuselage all broke away in the air and in fact these parts did so break away.

14. The main piece of wreckage included all the port wing, the starboard wing to inboard of No. 4 engine and the fuselage from stn 600k (leading edge of wing) to stn

1505 (fin rear attachment) and this fell almost vertically on to the wooded slopes of Fuji near an observation station at Tarobo, about 12 kilometres west of Gotemba. The forward part of the fuselage fell about 350 metres ahead and to the left of the main wreckage and the engines fell one to two kilometres ahead. The starboard outer wing broke into two main pieces and fell two to three kilometres before the main wreckage as did the fin, horizontal stabilisers and rearmost pieces of the fuselage. Smaller and lighter pieces of aircraft structure and passenger property were scattered for a distance of about 15 kilometres before the main wreckage.

15. Extract from the Official Report:

"The estimated flight path from Tokyo International Airport to Gotemba City, based on an 8 millimetre cine colour film of the countryside taken by a passenger on board, is as follows:

The aircraft, after taking off from Tokyo International Airport, flew over Samezu, made a right turn and proceeded, climbing, towards a point between Tokehama and Ofuna. It then made another right turn and flew over a point approximately 15 kilometres to the north west of Odawara City and approximately 5 kilometres to the north of Mount Myojindake at an altitude of 5 100 metres on a heading of approximately 246°M at an indicated airspeed of 320 to 370 knots. The aircraft subsequently flew over Gotemba City on a heading of approximately 298°M at an altitude of approximately 4 900

metres and indicated airspeed of 320 to 370 knots.

(Immediately after this, the film skipped two frames, followed by vague pictures of something like the passenger seats or cabin carpet, and suddenly came to an end).

16. The estimated flight path from Gotemba City to the crash site, based on the statements of many witnesses and the pictures is as follows: —

The aircraft, trailing white vapour, was losing altitude over the Takigahara area, and parts of the aircraft began to break away over Tsuchiyadai and Ichirimatsu.

Finally over Tarobo at an altitude of approximately 2 000 metres, the forward fuselage broke away. The mid-aft fuselage together with the wing, making a slow flat spin to the right, crashed into a forest at 2109 Nakahata, Gotemba City at approximately 0515 hours.

The forward fuselage crashed into the forest approximately 300 metres to the west of the above site and caught fire."

17. Notification of an aircraft accident was first made to the Gotemba police at 0515 hours. The police checked via the prefectural headquarters the movements of aircraft in the area and were told there had been no aircraft flying near Mount Fuji. Nevertheless the Gotemba police decided to investigate the accident report and at about 0645 hours the police station was

advised from the crash site that the wrecked aircraft was a Boeing 707. The Gotemba police quickly organised a large scale emergency force and some 300 personnel and equipment were brought to the scene.

18. By 1500 hours, all the victims had been removed from the area and taken to nearby Buddhist temples.

19. Post-mortem examinations of the flight crew members revealed no evidence of any pre-existing disease or drugs that might have affected the performance of their duties.

EXAMINATION OF THE AIRCRAFT WRECKAGE

20. The field examination of the wreckage included a preliminary examination of all the in-flight fractured by a Boeing metallurgist. He considered that all the fractures were of an overload type but in the case of the fin right rear fuselage fitting the fracture face included two small areas of fatigue one at each side of the top outboard bolt hole.

21. The fin fitting was released to Boeing for detailed metallurgical examination and they concluded that these cracks were not an accident cause factor.

22. The wreckage was subsequently taken to a hangar at Chofu airfield for further examination.

23. The analysis of the wreckage is as follows:

Extract from the Official Report.

"The starboard wing fractured at STA 733 and in the vicinity of STA 550; both fractures were in

the direction of wing tip up bending. All the pylons fractured at their wing attachments in the same manner, due to predominantly leftward load.

The forward fuselage failed to the left (and slightly downward) in the vicinity of STA 600K.

The aft fuselage fractured in the area between STA 1440 and STA 1592. The ventral fin fractured at its fuselage attachment section due to approximately leftward load and broke away from the fuselage.

The vertical stabilizer fractured at its attachment to the fuselage due to leftward load. The starboard rear attachment fitting (on fuselage side) of the vertical stabilizer fractured at the upper bolt hole due to tension load. Fatigue cracks were found on the fracture face of one of the bolt holes. Damage to the port horizontal stabilizer was extensive and dents, scratches and paint adhesion were found which are presumed to have been caused by it being struck by the vertical stabilizer. Subsequently the port horizontal stabilizer separated from the fuselage at its root.

The starboard horizontal stabilizer, which was almost intact, broke away from the fuselage together with the centre section. The jack screw rod of the horizontal stabilizer trim actuator fractured near the top end at the lower surface of the nut. The length of the screw from the stopper surface of the upper part of the screw and the upper surface of the nut was 105 mm corresponding to 1.4 units aircraft nose down on the pitch trim wheel scale in the cockpit.

Almost all instruments were destroyed by the fire in the forward fuselage and no useful data were available.

It is presumed that the aircraft was in cruising configuration because the flaps and the landing gear had been in the retracted position.

No structural defects were found in the airframe structure except the fatigue cracks in the vertical stabilizer rear spar attachment fitting.

No sign of malfunctioning was evident in the flying control systems, control surfaces and other systems.

There was no evidence of any pre-crash engine defect. No sign of explosion in the cabin was found.

Fire broke out in the forward fuselage at ground impact. It is presumed that a considerable amount of fuel entered the space below the forward fuselage floor as a result of the break up of the centre wing front spar, which took place when the forward fuselage broke in the air at STA 600K, and the damage to the centre fuselage fuel tank which appears to have occurred at the same time. None of the wreckage other than the forward fuselage caught fire.

LOAD AND STRENGTH OF AIRFRAME STRUCTURE

24. Based on the data submitted by the Boeing Company the strength of the airframe structure was investigated in accordance with airworthiness requirements

(CAR 4b) of the Civil Aviation Regulations, United States. For this analysis, it was assumed that the aircraft weight was 112 500 kilogrammes (252,000 pounds) and the airspeed 335 knots, EAS. The principal results were as follows:

i) The strength of the wing around STA 733 corresponds to a symmetrical load of 6.4g and, in the case of about 10° side slip, the wing load amounts to approximately 4.6g.

ii) The strength of the fuselage around STA 300K is the 5.6g downward and 4.1g sideward and that of the pylon attachment portion is 2.75g (inboard)—2.55g (outboard) sideward. Any of the above areas can stand a steady side slip in excess of 40°.

iii) a) The strength of the vertical fin for lateral load corresponds to the load which will be produced by lateral gust velocity (U_{de}) of 130 fps (75 kt) EAS or by side slip of 10°.

b) The horizontal stabilizer was designed for an ultimate distributed air load of 140,000 lb (margin of safety factor is approximately 0.15). This load corresponds to the load which will be produced by a downward gust velocity (U_{de}) of 225 fps (133 kt) EAS approximately."

ENGINES

25. Nos. 1, 2 and 4 engines were found about 1 km ahead of the main wreckage and No. 3 engine nearly 2 kms ahead of the main wreckage.

26. There was no evidence of fire and the condition of the rotating assemblies indicated that these had almost stopped at the time of impact with the ground. There had been no in-flight break-up of the turbines or compressors.

27. The fractures of the engine mountings indicated that the engines had all broken away to the left and downwards.

28. No. 3 engine had lost its side cowling and there was evidence that this engine had struck the wing leading edge just inboard of its position. Pieces of No. 3 engine cowling were found along the wreckage trail.

METEOROLOGICAL INFORMATION

29. Extract from the Official Report:

"a) Meteorological Conditions between Tokyo and Mount Fuji. A depression intensified during the night of 4th/5th March and moved rapidly NE across Japan. After this, there was an anticyclone over the Asian Continent and a depression over the sea to the east of Japan; a steep pressure gradient from west to east predominated over Japan at low levels.

On the afternoon of 5th March, westerly or north-westerly winds blew at the surface between Tokyo and Gotemba, the weather being fine with such good visibility that, quite unlike the previous day, Mount Fuji could be seen from Tokyo. At higher levels, the winds were generally west-north-westerly between Tokyo and the Mount Fuji area. Ac-

cording to the observations taken at the Fuji-san Weather Station (elevation 3 776 metres) at the same summit of Mount Fuji, the wind was 60 to 70 knots north-west and the temperature was —9 to —12° C.

b) Turbulence Reports from Aircraft

Air reports were collected from 100 aircraft which flew within 150 kilometre radius of Mount Fuji on 5th March. 79 aircraft among the 100 aircraft experienced turbulence, mostly below 3 000 metres, and principally at low altitude during climb or descent. 4 aircraft out of the 79 encountered severe turbulence within a 50 kilometre radius of Mount Fuji in its eastern quadrant.

c) Meteorological Service

The Tokyo Aviation Weather Service furnished the Company Operations personnel on duty with the prescribed weather charts regarding the flight between Tokyo and Hong Kong . . ."

30. The meteorological information collected during the investigation was analysed by the Meteorological Office, Bracknell and they also obtained the photograph which was taken by the weather satellite ¾ hr before the accident.

31. An extract from their conclusions is as follows:—

"A strong mountain wave situation existed over Honshu on 5 March 1966. Wave clouds were detected by satellite ¾ hour before accident time to west and southwest of Fuji; the lack of wave clouds

over Central Honshu is attributed to very dry air following the passage of WNW airstream over the Japanese Alps. The wavelength of lee waves is estimated at around 13 miles and there is considerable support for a case of wave resonance to the lee of Fujisan with the possibility of a rotor, in the vicinity of Gotemba where the accident is thought to have occurred. The precise effects of a conical mountain, such as Fujisan, on a system of waves set off by the Japanese Alps are not known but theory suggests that a first lee-wave of considerable amplitude could have existed. US Meteorologists, serving in the Tokyo area, with experience of the peculiarities of Fujisan considered the situation favourable for strong turbulence to lee of the mountain and also issued a CAT warning for levels below 12000 ft over eastern Honshu on the 5th about 4 hours prior to the accident. The main point of doubt is whether severe turbulence could have been associated with the lee wave system near Gotemba at 14 000-15 000 ft. . ."

AIRCRAFT HISTORY

32. The aircraft, was built in 1960; its Certificate of Airworthiness was valid until 28th April 1966.

33. At the time of the accident the aircraft had flown 19524 hours and completed 6744 landings. The last Certificate of Maintenance was issued following a B6 on Jan 1966. Aircraft hours at time of issue were 19119. Period of validity—60 days or 600 hours whichever occurs soonest.

CREW LICENSES

33. All crew licenses were in order.

ACTION

34. Resulting from the discovery of the fatigue cracks in the fin attachment fitting, a world wide inspection was carried out on all 707 aircraft. Most airlines found that on some of their aircraft they had cracked fittings. On six of the Company's 19 remaining 707 aircraft, 10 fittings were found cracked. All cracks were in excess of the rework limit so the fittings were changed. On four of these aircraft both rear fittings were cracked.

35. In August 1966 Boeing issued Service Bulletin 2422 to introduce stronger fittings and to reinforce the bulkhead to which they are attached. The fleet are now modified.

To: Members of Incident and Accident Information Group

FROM: IATA, London

DATE: 26th July, 1967

Boeing Exhibit No. D-6

(F. H. Jones, "Note on the Accident to B.O.A.C. 707, G-APFE in Japan on 5th March 1966," Royal Aircraft Establishment Technical Report—66322)

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OCTOBER
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ROYAL AIRCRAFT ESTABLISHMENT
TECHNICAL REPORT 66322

NOTE ON THE ACCIDENT TO B.O.A.C. 707, G-APFE IN JAPAN ON 5TH MARCH 1966

by

F. H. Jones, A. F. R. Ae.S.

MINISTRY OF TECHNOLOGY
FARNBOROUGH HANTS

IN CONFIDENCE

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SUMMARY

B.O.A.C. 707, G-APFE crashed in Japan on 5th March 1966. A visit was made to Japan during April/May 1966 to examine the wreckage of the aircraft.

It has been concluded that the aircraft disintegrated whilst flying at an altitude of about 5000 metres when it was about 7 kilometres to the southeast of Mt. Fuji.

The aircraft failed under sideload and there was no indication that the failures had been associated with any pre-crash weakness or malfunction.

Local sequence established that the rudder power control unit output rod failed before any other component in the tail unit, and that the lower third of the rudder was the first item to become detached from the tail. These features preceded failures of the fin, horizontal stabilizer and the forward fuselage.

It was also established that all four engines became detached in a common manner, and there were strong indications that this had occurred before failure and detachment of the outer starboard mainplane.

No overall sequence of failure for the whole aircraft could be determined. A study of the wreckage distribution, and of the trajectories of the falling pieces, did in fact suggest that much of the disintegration was virtually instantaneous, with no particular component markedly in advance of the others in the sequence of failure.

The examination of the wreckage did not produce any evidence as to the cause of the sideload which led to the disintegration of the aircraft.

Bocing Exhibit No. D-6

CONTENTS

Boeing Exhibit No. D-6

1 INTRODUCTION

B.O.A.C. 707, G-APFE, broke up in the air near Mt. Fuji, Japan shortly after leaving Haneda Airport, Tokyo, on 5th March 1966. Following a request from the Japanese Authority, transmitted by the Chief Inspector of Accidents, (U.K.), a visit was made to Japan during April/May 1966 by the writer to examine the wreckage of the aircraft.

This Report presents the results of the examination and also includes a report by Chemistry, Physics and Metallurgy Department on the fatigue cracking seen in the starboard rear terminal fitting in the vertical fin.

2. BRIEF DESCRIPTION OF ACCIDENT AND ITS INVESTIGATION

2.1 For completeness of this Report, a brief description of the accident and its investigation is given below.

B.O.A.C. 707, G-APFE, which was operating Flight BA 911 from Tokyo to Hong Kong, crashed on the eastern slopes of Mt. Fuji, near Tarobo (88 km west of Tokyo) at 14.15 hours (Tokyo time) on 5th March, 1966. The 113 passengers and 11 crew were killed, and the aircraft destroyed. The aircraft had taken off from Haneda Airport, Tokyo at 13.58 hours, and was cleared for a V.M.C. climb via Fuji to join the airway at Rebel.

The weather between Tokyo and Fuji was fine, with no cloud and good visibility. Nothing was heard from the aircraft after the routine communications, associated with departure, were completed when the aircraft was climbing through 600 metres.

At about 14.15 hours a large number of witnesses saw the aircraft falling from a considerable height, trailing white vapour, (Figs. 1 and 2).

2.2 The accident is being investigated by the Japanese Aviation Authorities, and investigators from the Accidents Investigation Branch, Ministry of Aviation, and from B.O.A.C. flew out from the U.K. to Tokyo within a few hours of the accident.

The investigators found that the aircraft had broken up in the air, and that pieces of the aircraft were scattered over an area of approximately 16 kilometres by 2 kilometres, (Fig. 3).

2.3 The main wreckage (Fig. 4), consisted of the mainplane from the port tip to just inboard of the No. 4 (starboard outer) engine position, and the fuselage from station 600 K (level with the front spar of the mainplane)

back to station 1505 (just aft of the pressure dome). This wreckage had fallen in a wooded area on the eastern slopes of Mt. Fuji, at a position approximately 12 kilometres west of the town of Gotemba. The elevation at this point is 1310 metres, a.m.s.l. The wreckage had fallen almost vertically through the trees and landed on the broken end of the starboard mainplane. The whole of the wreckage had shattered at ground impact and numerous pieces had been strewn around the accident site.

The main landing gears were complete and in the retracted condition, but had been extensively damaged at ground impact. The flap screw jacks, attached to the mainplanes, indicated that the flaps were in the retracted condition. All fuel tanks had ruptured and there was a strong smell of kerosene at the accident site, but there was no evidence of fire.

2.4 *The forward part of the fuselage* (station 600 K forward to the radome) was found about 300 metres to the

west of the main wreckage. It was extensively burnt, only the doppler bay and radome escaping damage by fire. This section of the fuselage had also fallen vertically through the trees and almost in a level attitude, fore and aft. It had landed on its starboard side. The nose gear was found in the retracted condition, but wheels and tyres had been burnt away. The trees around the wreckage were blackened by fire.

2.5 All *four engines* were found to the west of the main wreckage area. There was no evidence of fire on any engine.

2.6 The following major aircraft components were found between 1 and 2 kilometres to the east of the main wreckage.

(a) Outboard section of starboard mainplane (station 733 to tip).

(b) Portion of starboard mainplane, including No. 4 engine mounting.

(c) Starboard side of horizontal stabilizer, complete with elevator.

(d) Rear part of vertical fin, with upper two thirds of rudder.

There was no evidence of fire on any of these components.

2.7 All of the wreckage was collected by the Japanese investigators, and reassembled in a large building at Chofu, near Tokyo, (Figs. 5, 6 and 7) where it was examined.

3 Examination of the Wreckage

3.1 It was apparent from a study of witnesses' statements, investigators' reports from the accident site, and

from a general examination of all the wreckage assembled

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at Chofu, that the main areas of breakage in the air were as follows:—

(a) fuselage, forward of front spar position of mainplane,

(b) all four engine pylons,

(c) outer starboard mainplane

(d) horizontal and vertical tail surfaces.

It was to these areas (Fig. 8) that particular attention was given by the writer during the detailed examination of the wreckage. Details of the examination are given in Appendix A; the conclusions are summarized in the following paragraphs.

3.2 *Forward fuselage*

Separation of the forward fuselage from the aircraft had occurred just forward of station 600 K, where failure of fuselage skin, stringers and the heavy frame at 600 K, had taken place. The failures are described in Appendix A.2.

It was concluded that the forward fuselage had become detached from the main fuselage by pivoting nose to port about the mainplane front spar position. No evidence was seen to suggest that any vertical loading, either upwards or downwards, had been applied during separation of the forward fuselage. No evidence was found of impact of the forward fuselage with other parts of the aircraft.

3.3 *Engines*

All four engines became detached from their pylons through failure of either the engine mounting attachments, or the pylon structure. The failures are described in Appendix A.3.

It was concluded that all four engines became detached from the mainplane in a similar manner, by pivoting to port about their attachments. No. 3 engine struck the leading edge of the mainplane just inboard of the engine position, after separation, but no evidence was found of impact of engines with other parts of the aircraft.

3.4 *Fin and rudder*

The failures of the fin and rudder are described in Appendix A.4. It has been deduced from the examination of the wreckage that the fin and rudder were subjected to an aerodynamic sideload from the starboard side, as a result of

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which, the output rod connecting the rudder to its power flying control unit, failed in compression; at this time the rudder was at an angle of 5° 42′ to port.

After failure of the rod the rudder swung fully to port breaking the bottom two hinges and damagin the other hinges. The lower third of the rudder then failed by bending to port and upwards and became detached.

The fin then became detached from the fuselage by tension failure in the starboard rear terminal fitting and starboard front spar, by compression failure in the port front spar, and by torsion failure of the port rear terminal fitting.

It is likely that the first part of the fin to fail was the starboard rear terminal fitting at a 5/16″ diameter bolt hole which contained evidence of pre-crash fatigue crack-

ing (Appendix B). However since rudder failure appears to have preceded fin failure it is considered most unlikely that the fatigue damage to the fin fitting played a significant part in the accident.

After failure, the fin rotated downwards to port and struck the port side of the horizontal stabilizer, in consequence of which, disintegration of both fin and stabilizer occurred. The upper two thirds of the rudder remained on the rear part of the fin until ground impact.

3.5 *Ventral fin*

The ventral fin became detached from the rear fuselage by bending to port about its attachments. There was no evidence to suggest that the ventral fin had been struck before its failure, or that it struck any other part of the aircraft. The ventral fin was found 6 kilometres east of the main wreckage.

3.6 *Horizontal stabilizer and elevators*

It can be shown conclusively that all damage to the horizontal stabilizer and elevators was consequent upon the port side of the stabilizer being struck by the fin. No detailed descriptions of the damage have therefore been given.

The *port side of the stabilizer and its elevator* had broken up extensively as a direct result of impact by the vertical fin. The fin had fallen on the leading edge of the stabilizer and rotated round under it, sliding to the rear, causing disintegration of the central portion of the stabilizer in the process. The outer portion became separated, and the inboard portion became detached from its centre-section by bending backwards, in the horizontal plane.

All elevator damage and failures were compatible with the elevator having been in position on the stabilizer when the latter disintegrated.

The *starboard side of the stabilizer and its elevator* became detached from the fuselage as a complete assembly, and remained so after striking the ground. The detachment had resulted from disruption of the centre-section of the stabilizer and adjacent rear fuselage structure, when the port side of the stabilizer had been struck by the vertical fin. It is deduced that the assymetric loading of the damaged centre-section and adjacent fuselage by the starboard side of the stabilizer had caused the damage and detachment.

3.7 *Starboard mainplane*

The mainplane had broken outboard of station 387 (approximately No. 3 engine position) resulting in the production of two large pieces of structure, and several pieces of upper surface skinning, and internal structure. The damage is described in Appendix A.5.

It was concluded from the examination, that the mainplane had failed by bending tip upwards, breakage occurring at two places, with the failures progressing chordwise, from trailing edge to leading edge.

There was no evidence that the detaching pieces of the mainplane had struck any other part of the aircraft.

3.8 *Flying control systems*

Very little of the flying control systems was seen at Chofu in the assembled wreckage. The flight deck had disintegrated at ground impact, and all cable runs had been broken into many pieces, or were missing, so that no over-

all study of the systems could be made. It had been possible, however, to determine relevant control surface angles for the outboard aileron (starboard) (Appendix A.5) and the rudder (Appendix A.4) from consideration of the failures of adjacent aircraft structure.

3.9 *Horizontal stabilizer trim setting*

It was possible to obtain a probable setting for the horizontal stabilizer when the aircraft disintegrated in the air. Details of the evidence obtained during the examination are given in Appendix A.6.

The salient features were as follows:—

(a) the control drum under the flight deck, was at a position, equivalent to a flight deck hand wheel setting of NEUTRAL,

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(b) the rear cable drum was found with its operating cables severed close to the drum and the cables were 1½ turns below the normal FULL NOSE DOWN limit position on the drum,

(c) the actuating screw jack was broken when the stabilizer centre-section became detached, and its nut was on the detached portion against the fractured end. The nut position was equivalent to a flight deck hand wheel setting of 1¾ divisions, NOSE DOWN.

It is concluded (Appendix A.6) that the stabilizer was probably at NEUTRAL, when the damage to the tail was initiated. The various settings in the trim system, showed that the fin and rudder failures must have preceded the detachment of the forward fuselage.

3.10 *Salient features determined by the wreckage examination*

The salient features (Fig. 9) determined by the wreckage examination are:—

(a) the sequence of failures in the tail unit, involving the rudder operating rod, rudder, fin and horizontal stabilizer, can be traced through the wreckage, and is consistent with an aerodynamic sideload from starboard to port upon the vertical tail surfaces,

(b) the forward fuselage became detached by pivoting nose to port,

(c) the settings of the components in the stabilizer trim system, show that (a) above must have preceded (b) above,

(d) the engines all became detached in identical manner, by pivoting to port about their mountings,

(e) the starboard mainplane failed by bending tip upwards, with no evidence of drag loads, during separation from the aircraft. The breakages in the mainplane extended spanwise from No. 3 engine position, out to beyond No. 4 engine position,

(f) (d) above, must have preceded (e) above, to permit the consistent pattern of engine detachment,

(g) there was evidence of pre-crash fatigue cracking at the point of origin of the fin failure in the starboard, rear, terminal fitting, but the fitting failure was subsequent to the rudder being damaged,

(h) the ventral fin became detached by bending to port about its attachment to the fuselage,

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(i) no evidence of malfunction was seen on any component examined.

It was not possible to resolve a sequence between (a), (d) and (h) above, directly from the wreckage examination.

4 Analysis of the Wreckage Distribution at the Accident Site

When structural disintegration of an aircraft occurs in flight, the many pieces which break away, form a trail on the ground. An analysis of the trail, by the method outlined in Appendix C.1 can sometimes give information which may assist in determining the height at which the detachment occurred, and a possible sequence of detachment.

In the case of G-APFE, very strong winds were blowing from just north of west at the time of the accident (Fig. 10) and a very long trail of wreckage (Fig. 3) resulted along the wind line. In addition to this a study of the planform of the distribution (Appendix C.2), showed that the aircraft was flying on a track across the wind, and to south of west. The analysis of the trajectory plots of the falling pieces (Fig. 11) together with the study of the planform (Fig. 12), suggests that the aircraft disintegrated at an altitude of about 5000 metres when it was about 7 kilometres to the south-east of Mt. Fuji.

No clearly defined order of detachment of components could be determined.

5 Conclusions

It has been concluded that the B.O.A.C. 707, G-APFE, disintegrated in the air whilst flying at an altitude of about 5000 metres and about 7 kilometres to the south-east of Mt. Fuji.

The aircraft failed under sideload; there was no indication from the examination of the wreckage that the failures had been associated with any premature structural failure or malfunction of the aircraft systems.

Although evidence was seen of previous fatigue damage to the fin starboard rear terminal fitting, a local sequence showed that the rudder power control unit output rod failure and the detachment of the lower third of the rudder had preceded all other failures in the tail unit, including the terminal fitting, and also the detachment of the forward fuselage. It was concluded, therefore, that the fatigue damage had not played a significant part in the accident.

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The examination of the wreckage also indicated that the detachment of all engines, in a common manner, had preceded the failure and detachment of the outer starboard mainplane.

Although it was possible to establish such local sequences as above, the analysis of the wreckage evidence did not indicate an overall sequence for the whole aircraft. The study of the wreckage distribution, and analysis of the trajectory plots, did in fact suggest that much of the disintegration of the aircraft was virtually instantaneous, and that no particular component was markedly in advance of the others in the sequence of failure.

The examination of the wreckage did not produce any evidence as to the cause of the sideload which led to the disintegration of the aircraft.

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Appendix A

Examination of the Wreckage of B.O.A.C. 707, G-APFE at Chofu

A.1 *General*

This Appendix gives details of the wreckage examination and supplements Section 3 of the Report.

A.2 *Forward fuselage*

Separation of the forward fuselage from the aircraft had occurred just forward of station 600 K, where failure of fuselage skinning, stringers and the heavy frame at 600 K had taken place. The failures are illustrated in Figs. 14, 15 and 16.

There was evidence of fore and aft tension loading on the starboard side of the fuselage, and of compression and bending on the port side of the fuselage. The starboard bottle pin (mainplane attachment bolt) had been pulled out of the spar by forward movement of the forward fuselage relative to the mainplane. The port bottle pin had remained in position in the frame/mainspar assembly; the heavy frame had failed just below the port bottle pin position in a manner consistent with the forward fuselage having pivoted to port about the frame.

The longitudinal stringers on the port side and the top three on the starboard side had failed in compression. The longitudinal stringers and skin on the starboard side, from No. 5 stringer at the top, had failed in tension. There was evidence of heavy compression buckling in the fuselage skin down the port side.

It was concluded that the forward fuselage had become detached from the main fuselage by pivoting nose to port,

about the mainspar position. No evidence was seen to suggest that any vertical loading, either upwards or downwards, had been applied during separation of the forward fuselage. No evidence was seen of impact of the forward fuselage with any other part of the aircraft.

All fracture surfaces examined exhibited normal characteristics for the materials used in the construction of the fuselage, and no evidence was seen of pre-crash weakness or defect which might have contributed to the cause of the fuselage failure.

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A.3 *Engines*

A.3.1 *No. 1 engine*

The salient features noted during the examination were as follows:—

(a) The *upper pylon strut* failed by bending laterally to port about 30 cm to the rear of the mounting attachment pin.

(b) The *starboard side mounting* failed at its attachment under fore and aft tension loads, shearing the transverse attachment pin, and breaking a strut lug.

(c) The *port side mounting* failed by bending to port, about 15 cm to the rear of the mounting attachment pin.

(d) The *lower pylon strut* failed at its attachment to the mainplane by bending with the lower, forward end, moving to port.

(e) The pylon, lower fairing, or 'sailboat', became detached when the engine broke away from the pylon, and its damage is consistent with the engine moving round to port about its attachments.

(f) No evidence was seen of any vertical loading, apart from a slight downward component in the pin shear on the starboard side attachment, (b) above.

A.3.2 *No. 2 engine*

The salient features noted during the examination were as follows:—

(a) The *upper pylon strut* failed by bending laterally to port, about 60 cm to the rear of the mounting attachment pin.

(b) The *starboard and port side mounting attachment assemblies* were intact, and engine detachment had been caused by breakage of the local structure. Unfortunately the structure was destroyed at ground impact, and no useful evidence of the mode of failure could be deduced from the remains.

(c) The *lower pylon strut* failed through its forward attachment lugs, by bending to port. Markings on the lug faces, indicate that the bending had been quite pronounced.

(d) No evidence was seen of any vertical loading at the points of separation.

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A.3.3 *No. 3 engine*

The salient features noted during the examination were as follows:—

(a) The *upper mounting* failed by bending laterally to port, just forward of the attachment pin to the upper pylon strut.

(b) The *starboard side mounting* attachments were intact, and separation was caused by failure of the local

structure, under fore and aft tension loads. The failure had progressed from starboard to port across the structure.

(c) The *port side mounting* attachments were intact. The local structure was destroyed at ground impact, and no useful evidence was deduced from the remains.

(d) The *lower pylon strut* failed through its forward attachment lugs, by bending to port. Markings on the lug faces indicate that the bending had been quite pronounced. No evidence of vertical loading was seen, except at the final point of separation in the fracture surface.

(e) Damage on the port side of the upper pylon strut fairing could be matched to comparable damage along the leading edge of the starboard mainplane immediately inboard of the engine position, indicating that the engine had pivoted right back on the mainplane during its detachment.

A.3.4 *No. 4 engine*

The salient features noted during the examination were as follows:—

(a) The *upper pylon strut* failed by bending laterally to port.

(b) The *starboard side mounting* attachment pin failed in double shear, i.e., due to fore and aft tension loads along the mounting. No downward component was evident in the shear pattern on the pin.

(c) The *port side mounting* failed through its attachment by shear of the transverse pin, and breakage of a strut lug. Local evidence of a slight downward component

in the lug failure, suggested that it was the final point of separation.

(d) The *lower pylon strut* failed in the tube, just to the rear of its forward attachments to the engine mounting. The failure was by bending laterally to port. The sealant compound at the forward attachments to this strut was unbroken, indicating that no downward component, or pivoting downward, of the engine had taken place.

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A.4 *Fin and rudder*

A.4.1 *Fin*

The fin became detached from the aircraft as a result of failure of the fin spars at, or adjacent to, the terminal fittings in the fuselage bulkhead (Fig. 17). The main features of the separation were as follows:—

(a) The *starboard, rear, terminal fitting,* in fuselage bulkhead 1505, failed under vertical tension loads (Fig. 18(a)). Failure had progressed across the I section fitting from the forward, outer leg, and had terminated at the ends of both inner legs, where local bending had occurred. The origin of failure was located at the top, outboard 5/16 inch diameter hole in the forward, outer leg, and evidence was seen of pre-crash fatigue cracking along the bore of the bolt hole. This failure is dealt with in greater detail in Appendix B. The fin attachment pin in the fitting was undamaged. No evidence was seen of any loading other than the vertical tension associated with the fitting failure.

(b) the *port, rear, terminal fitting,* in fuselage bulkhead 1505, failed under combined torsion and bending loads (Fig. 18(a)). The loading sense was with the upper part of the

fitting (that is, the fin), rotating anti-clockwise, relative to the lower part (that is, the fuselage) when viewed from above. The fin attachment pin was undamaged. No evidence was seen of any fatigue cracking in the fitting.

(c) the *front spar, starboard side,* failed in tension above the attachment pin (Fig. 18(b)). The fin attachment pin remained intact, but had almost failed in double shear (Fig. 19) due to vertical tension loads on the fitting.

(d) the *front spar, port side,* failed as a strut in compression, (Fig. 18(b)) above the attachment pin. The fin attachment pin remained intact but had almost failed in double shear (Fig. 19) due to vertical compression loads on the fitting.

(e) *the failures* of the front spar booms and the damage to the attachment pins, collectively indicate a fin spar bending failure due to loads on the fin from the starboard side. Fin detachment was therefore dependent upon three main breakages:—

(a) tension failure of the starboard rear terminal fitting,

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(b) bending failure of the front spar,

(c) torsion/bending failure of the port rear terminal fitting.

The characteristics of the torsion/bending failure of the port rear terminal fitting required prior separation of both the front spar and the starboard rear terminal fitting. The latter contained no evidence of loading, other than direct vertical tension, and its failure must therefore have pre-

ceded the compression collapse of the port side of the front spar.

It is concluded then, that the first separation in the fin structure occurred in the starboard, rear terminal fitting, and that this separation was initiated at the top, outboard 5/16 inch hole in the forward, outer leg of the fitting.

(f) The fin rotated to port and downward during its separation from the fuselage, and struck the port side of the horizontal stabilizer along its leading edge. Mutual damage was caused between fin and stabilizer (Fig. 20 and 21) in consequence of which, distintegration of both items occurred.

(g) The examination of the fin did not reveal any evidence of impact that could have been caused whilst the fin was still in place on the fuselage.

A.4.2 *Rudder*

The rudder was found adjacent to but separate from the rear part of the fin in the wreckage trial. Only the upper two thirds of the rudder was present, the remaining third being found 1500 metres to the east. The main features (Fig. 22) were as follows:—

(a) The output rod between the rudder and its power flying control unit had failed in compression with the rod bending and breaking 5¾ cm forward of its attachment to the rudder spar (Fig. 23). The failure of the rod "locked" the position of the power control jackrod and showed that the failure had occurred when the rudder was 5° 42′ to port. The compression failure indicated that there were external loads from starboard, moving the rudder to port.

(b) The wreckage showed that the whole of the rudder had moved fully to port, damaging all its hinges. The bottom hinges had been broken by this movement.

(c) The bottom third of the rudder was bent upwards and to port, and broke off. This must have happened after the bottom hinge failed. The base of the rudder was not

damaged and this indicates that the bottom third could not have been attached when the fin became detached; otherwise the base would have struck the fairing fuselage structure on the port side.

(d) The remaining hinges finally broke under inertia forces when the bottom of the fin struck the ground.

(e) There was no evidence that the rudder had been struck in flight so that it was concluded that the sideloads were aerodynamic.

A.5 *Starboard mainplane*

The main features (Figs. 24 and 25) of the failures were as follows:—

(a) The separation at station 733 (i.e. outboard of No. 4 engine) was clearly defined. The upper skin had failed under spanwise compression with marked local buckling of the skin right across the chord.

(b) Reconstruction of the pieces of the upper skin between stn. 586 and 387 showed that the pattern of disruption could be reduced to two major spanwise cracks which had progressed from stn. 586 inboard to stn. 387 all other failures had developed from these two cracks which appeared to be tension failures as a result of spanwise compression.

(c) The lower surface skinning at station 733 had failed under tip upward bending loads. The final separation had progressed from trailing edge to leading edge.

(d) The only other separation of the lower surface occurred immediately inboard of No. 4 engine position. This too progressed forward starting with a spanwise tension failure at the rear spar and developing into a tearing failure with the outboard section moving upward relative to the inboard.

(e) The disruption of the upper skin, together with the failure of the lower skin inboard of No. 4 engine led to the detachment of the second large piece of mainplane structure. The rear spar in this section contained marked tip upward deflection shear buckles in the web.

(f) It had been determined by the investigators that the mainplane flaps were in the retracted position at the time of the accident. The portion of the aileron outboard of station 733 should then have been locked at NEUTRAL; although this could not be confirmed the wreckage indicates that the aileron angle did in fact correspond to NEUTRAL.

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(g) All the damage to the mainplane followed the common pattern of tip upward deflection with lower skin failures running from trailing edge to leading edge. There is some indication from this that the aircraft was no longer in the normal forward flight when the wing failed.

A.6 *Horizontal stabilizer trim setting*

The trim system control drum, from beneath the flight deck floor, and parts of the rear actuating assembly, were available for examination. Details are given on Fig. 26 of

the condition of the components, and these conditions were set up on an aircraft at London Airport to obtain approximate interpretations.

From this it was determined that:—

(a) The control drum beneath the flight deck was at a position equivalent to a flight deck hand wheel setting of NEUTRAL.

(b) The rear cable drum was found with its operating cables 1½ turns below the normal NOSE DOWN limit position, and both cables had been broken close to the drum.

(c) The actuator screw was broken when the horizontal stabilizer centre section became detached with the starboard side of the stabilizer, and the nut which controls the stabilizer setting was found immediately above the breakage of the screw. The position of the nut corresponded to 1¾ divisions NOSE DOWN on the flight deck hand wheel.

(d) The operating cable system includes two cables between the flight deck and the rear assembly, and these cables pass along the full length of the fuselage, under the floor. They are positioned 60-75 cm on either side of the aircraft centre-line. Any breakage of the fuselage, such as occurred at station 600 K (A. 2) would cause tension loads to be introduced into the cables, and depending on which cable failed first, the rear drum would be wound by the surviving cable until it failed, or the drum reached its limit. Failure of the starboard cable, corresponding to a starboard tension failure of the fuselage, would wind the rear drum NOSE DOWN, and since the drum was found with its cables beyond the normal travel in this direction, it is concluded that it was the starboard cable which broke first during the fuselage failure.

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The marked disparity between the nut position on the screw and the rear drum setting, indicates that the latter was only obtained after the stabilizer became detached,

—18—

and the nut and screw removed from the aircraft. It is concluded that the drum setting was produced in consequence of the fuselage failure at 600 K.

It is likely that the cable movements also produced the disparity between the forward control drum and the nut position on the screw, since, tension in the port (surviving) cable would produce a NOSE UP sense change in the drum setting and a NOSE DOWN sense change in the nut position.

Three situations can therefore be postulated for the actions of the cable when the fuselage failed.

(a) The hand wheel (forward drum) remained fixed, and the disparity was caused because the screw jack moved. Thus the system would have been at a NEUTRAL setting, initially.

(b) The screw jack did not move, but the hand wheel moved. Thus the system would have been at 1¾ divisions NOSE DOWN initially.

(c) Both the hand wheel and the screw jack moved, the former towards NOSE UP and the latter towards NOSE DOWN. Thus the system would have been at some intermediate setting, initially, between NEUTRAL and 1¾ divisions NOSE DOWN.

Situation (b) above, is unlikely, because this would have required the rear assembly to be held fixed at the 1¾ divisions position, until the horizontal stabilizer had completely broken away, and then to be freed, to allow the rear drum to be wound down to a setting beyond the full NOSE DOWN limit.

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Situation (c), is also unlikely, because, after the screw jack was broken with the nut in the position equivalent to 1¾ divisions NOSE DOWN, the rear assembly continued to operate to put the drum cables down beyond the DOWN limit, *yet the forward drum (and hand wheel) did not go beyond the NEUTRAL setting in the NOSE UP direction,* and jamming of the forward drum would have had virtually to coincide with the breakage of the screw jack in the rear of the aircraft.

It is considered that (a) is the likely situation, and that the trim system was at the NEUTRAL setting when the fuselage failed, and that the NOSE DOWN setting of the nut on the screw jack, when the stabilizer centre-section became detached, had been achieved by loads in the port trim cable when the forward fuselage was separating from the aircraft.

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It might then be thought that the forward fuselage failure had preceded that of the tail unit, but the stabilizer centre-section detachment, was the last action in the sequence of failures and damage that could be traced through the tail unit. (A. 4 and Section 3.6)

To determine whether the forward fuselage failure had occurred before the failure of the rudder P.F.C.U. output rod, (the first item in the tail unit sequence), a comparison of the elapsed times would be necessary:

(i) From the moment of the road failure, through the sequence of rudder over-ride, lower rudder portion detachment, fin failure and rotation over to port to strike against the port side of the horizontal stabilizer, disintegration of the latter, and damage to the fuselage and stabilizer centre-section, and consequent detachment of the star-

board side of the stabilizer, with the centre-section then breaking the screw jack to establish the nut position.

(ii) From the amount of forward fuselage failure at station 600K, through the sequence of breakage of the starboard trim cable, and operation of the rear assembly from the NEUTRAL position to 1¾ divisions NOSE DOWN, at which time the screw jack failed.

It is considered that (i) above is likely to be the longer sequence, in time, and hence the tail unit damage would have been initiated before the fuselage failure. Reference to Appendix C.3 tends to support this conclusion.

It is finally concluded therefore, that the stabilizer was probably set at NEUTRAL at the time the tail unit damage was initiated, and that during the failure of the fuselage, the stabilizer moved to the setting determined from the nut position, under the action of the surviving port trim cable. The forward fuselage failure was therefore subsequent to the initiation of the tail unit damage and most probably occurred during the sequence of tail unit damage.

Appendix B

METALLURGICAL EXAMINATION OF FATIGUE FAILURE IN STARBOARD, REAR, TERMINAL FITTING OF FIN

(see Section 3.4)

Report by Chemistry, Physics and Metallurgy Department, R.A.E.

R.A.E. Ref. M10178/E418/CAS *1st July 1966*

Accident to B.O.A.C. Boeing 707 G-APFE, Tokyo, 5.3.66

Certain fractures and mounted metallographic specimens from the right hand fin body terminal from B.O.A.C. Boeing 707 G-APFE, were supplied by Mr. B. Folliard, Chief Inspector of Accidents B.O.A.C., for examination in C.P.M. Department.

A report on the fin body terminal had been issued by The Boeing Company, and the hole designation used therein will be adhered to throughout the present report. This was as follows:—

Right hand fitting, outboard row numbered R1, R3, R5, etc from top to bottom.

Right hand fitting, inboard row numbered R2, R4, E6, etc from top to bottom.

The fin body terminal was fabricated from a forging made from 4340 steel to Boeing Material Specification 7-28 and was heat treated to 180 000—200 000 psi strength level.

The fracture origin on one side of hole R1 is shown in monochrome in Fig. 27, and in colour in Fig. 28. The area indicated ABCD Fig. 27, exhibits features characteristic of fatigue fracture. In the fracture sequence the area of fatigue was followed by an area of plane strain fracture BCDE, and this in turn was followed by plane stress frac-

ture to complete rupture. The area of plane strain fracture can be clearly seen in Fig. 28, and is indicated A. It is apparent from Fig. 28 that corrosion of the fatigue areas of the fracture had occurred. Fig. 29 shows that fatigue cracks started at seven levels, at least, in the bore of hole R1. These are indicated A, B, C, D, E, F and G. Fig. 29 also shows considerable corrosion pitting of the bore of hole R1. Part of another fracture, Fig. 30 was also received. Failure had been initiated by fatigue fracture and multiple fatigue crack initiation was again apparent. The latter feature can be seen in Fig. 31, fatigue

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levels being indicated A, B, C, D and E. Fig. 31 also shows corrosion pitting and oxidation of the bore of the hole.

Metallographic examination of a cross section through hole R1 revealed considerable corrosion pitting. A typical example is shown in Fig. 32, with oxide filled pits indicated A, B and C. The metallographic section through hole R1 also revealed cracks whose surfaces had become oxidised. These are indicated A and B in Fig. 33, and are shown in greater detail in Figs. 34 and 35.

The Boeing report had noted a pocket of untempered martensite in the cross-section at the crack origin of hole R3. This is shown in Fig. 36. Microhardness measurements were made in this region and the hardness values at the positions indicated are given in Fig. 37. The figures confirm the suggestion that martensite is present in such regions. Other pockets of untempered martensite were observed in this cross-section and are shown in Fig. 38. Associated cracks are indicated A and B, Fig. 38, and are shown in greater detail in Fig. 39. A further pocket of

untempered martensite was observed on the facing of hole R1, and is shown in Figs. 40 and 41.

It seemed likely that the observed regions of untempered martensite had been produced during the drilling and facing of the holes, and as tensile test pieces that had been machined by The Boeing Company to check the sensile properties of the fitting were also received, these were examined. Surface machining marks on the shoulder of one of these test pieces are indicated A in Fig. 42. A transverse metallographic specimen prepared on material out from this area revealed regions of untempered martensite associated with these heavy machining marks. Typical examples are shown in Figs. 43, 44 and 45. The similarity between Fig. 36 and Fig. 45 is considered noteworthy.

Conclusions

It is concluded that failure of the right hand fin body terminal initiated at an area of fatigue cracking in hole R1.

There was evidence of considerable corrosion pitting in the bores of the holes examined, and the multiple initiation, and the metallographic sections, suggest that fatigue crack initiation was associated with this corrosion pitting. That an element of corrosion fatigue was involved in crack growth was evidenced by the oxidised condition of the fatigue areas on the fracture surfaces, and by the oxide filled cracks observed in the microsections.

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It is suggested that the regions of untempered martensite associated with the holes in the right hand fin body terminal were formed by machining operations during fabrication. It is not possible to say how extensive the formation of such regions had been, as the subsequent

corrosion observed in the bores would tend to remove such zones. The effect of regions of untempered martensite on fatigue crack initiation is not known, but examples were observed near the crack origin of hole R3 where cracks were associated with these regions. However, in view of the general corrosion pitting observed in the bores of the holes examined it seems likely that corrosion exerted an overriding influence on crack initiation, and played a part in subsequent fatigue crack growth.

Fig.1

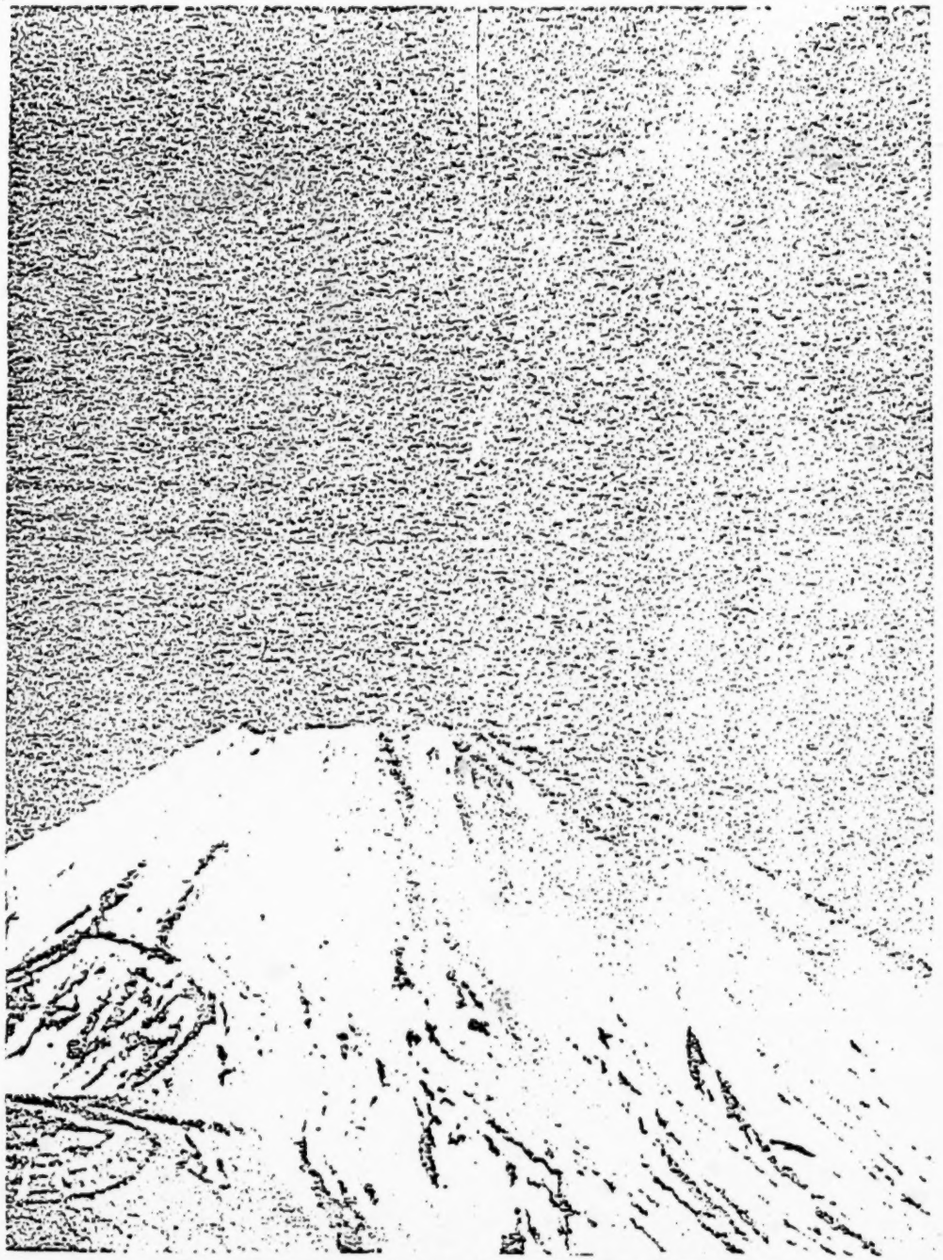

Fig.1 Aircraft descending near Mount Fuji after disintegration

T.R. 66322

Boeing Exhibit No. D-6

Fig.2

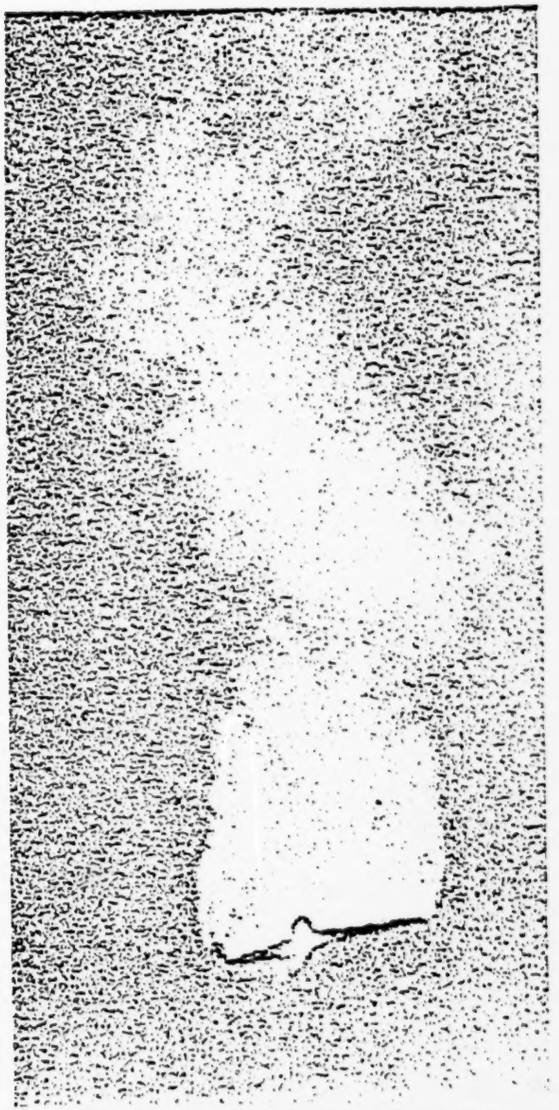

Fig.2 Aircraft spiralling down vertically after detachment of tail unit, engines, forward fuselage and outer starboard wing

Boeing Exhibit No. D-6

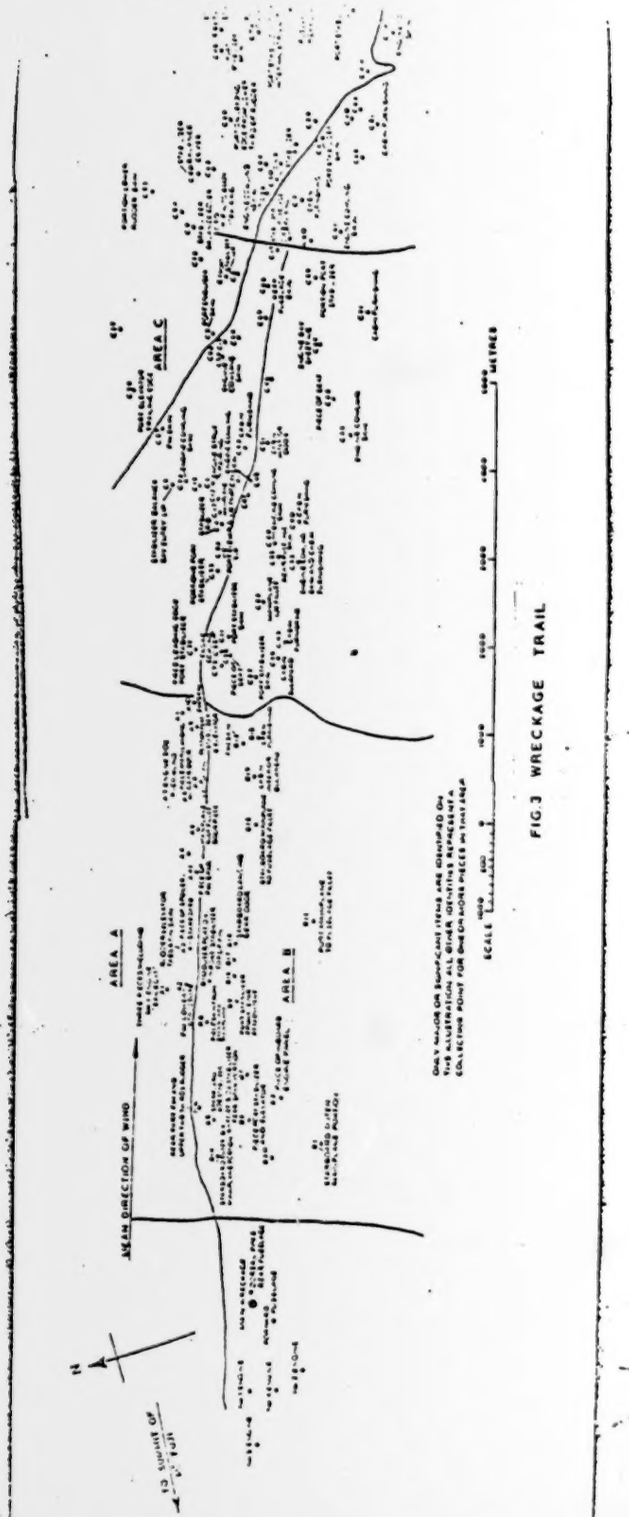

FIG.3 WRECKAGE TRAIL

Boeing Exhibit No. D-6

Fig.4

Fig.4 Main wreckage of aircraft

Boeing Exhibit No. D-6

Fig.5

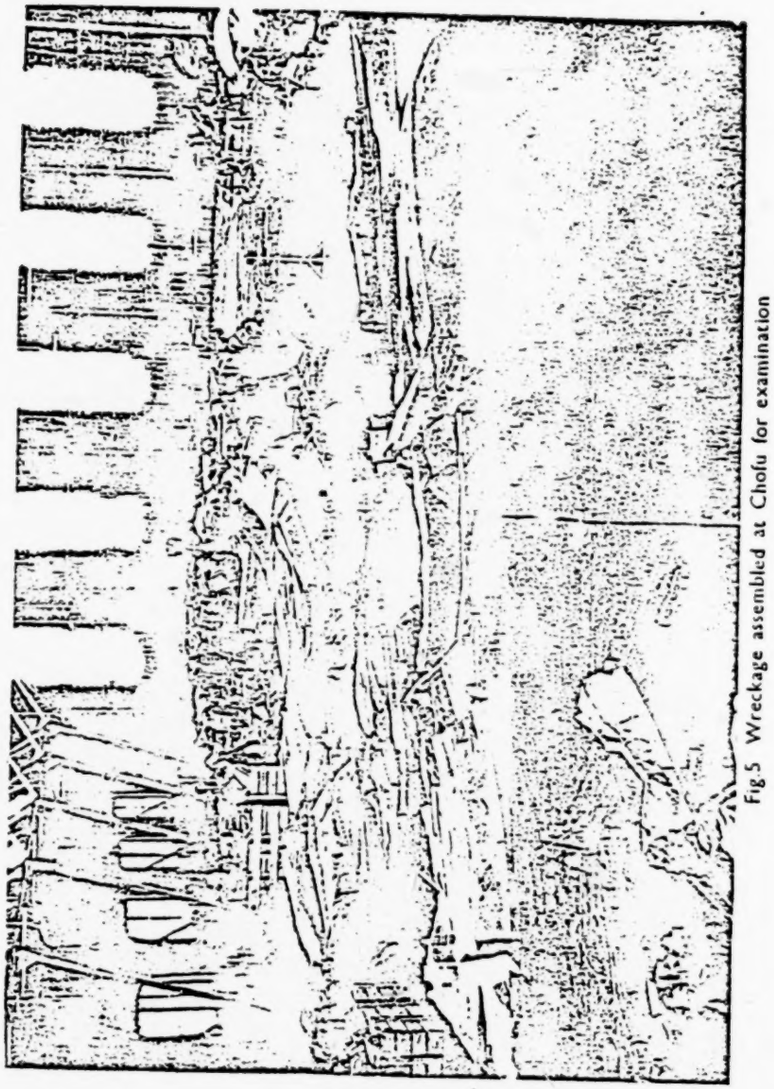

Fig.5 Wreckage assembled at Chofu for examination

212a

Boeing Exhibit No. D-6

Fig.6

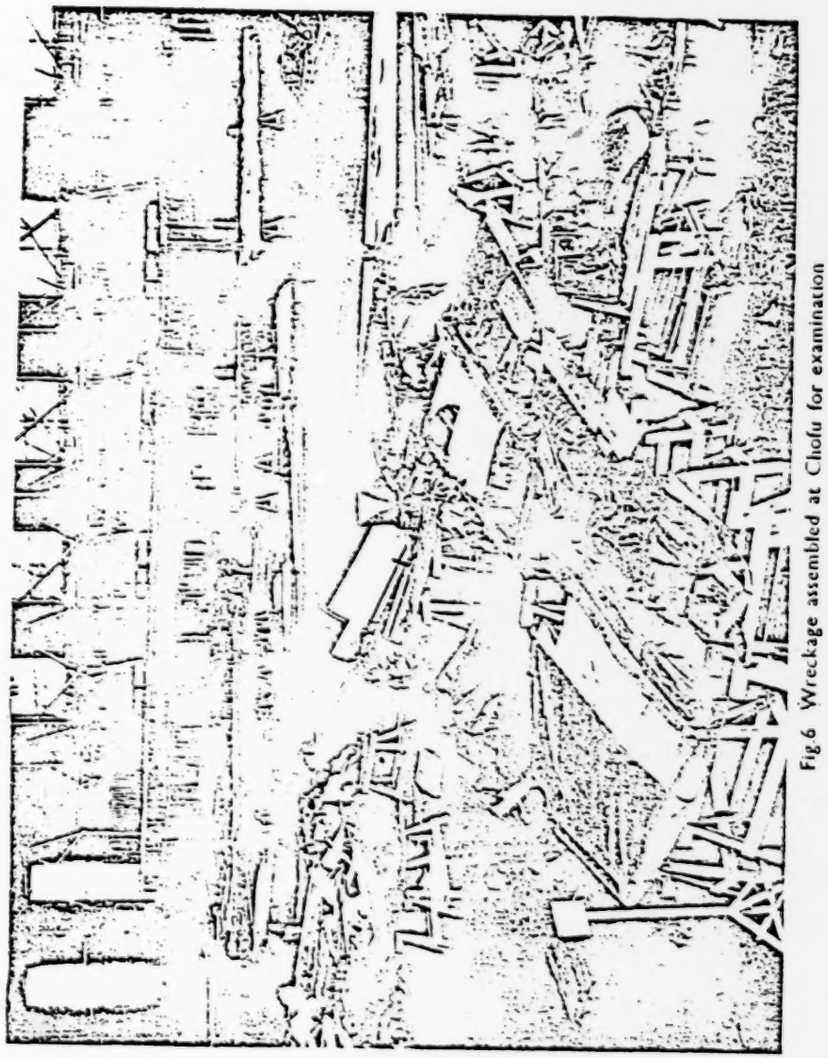

Fig 6 Wreckage assembled at Chofu for examination
(Port horizontal stabilizer and elevator in foreground)

391

213a

Boeing Exhibit No. D-6

Fig.7

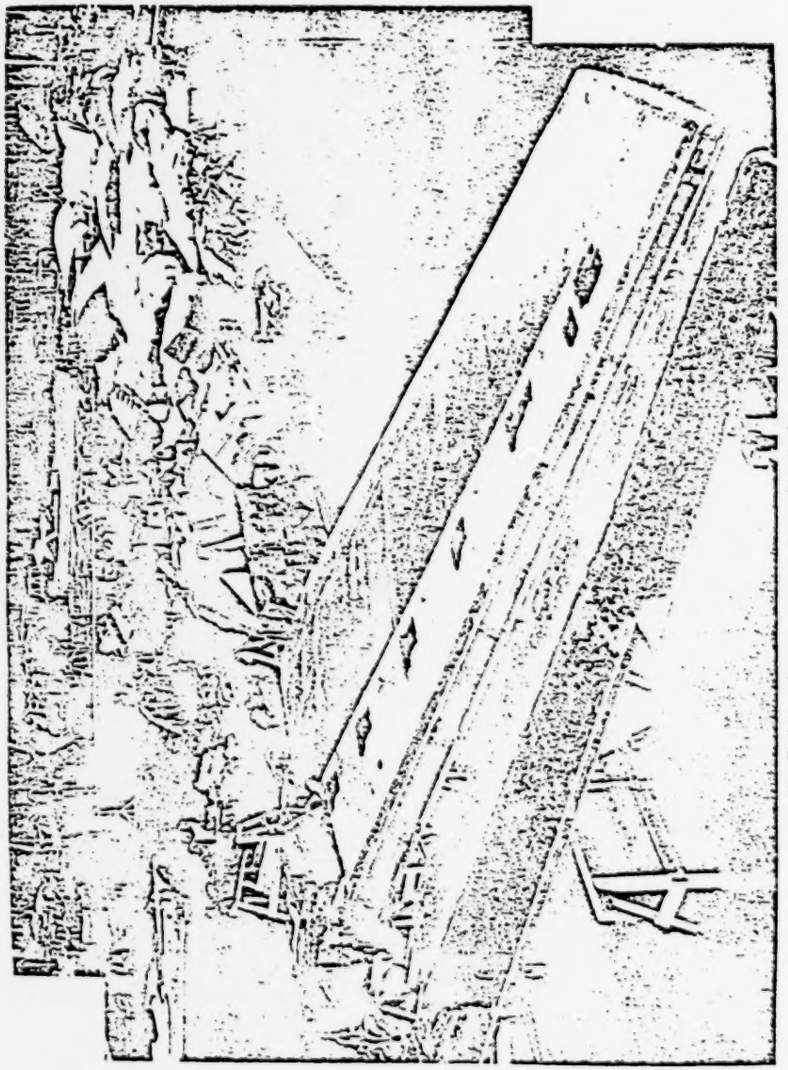

Fig.7 Wreckage assembled at Chofu for examination
(Starboard horizontal stabilizer and elevator in foreground)

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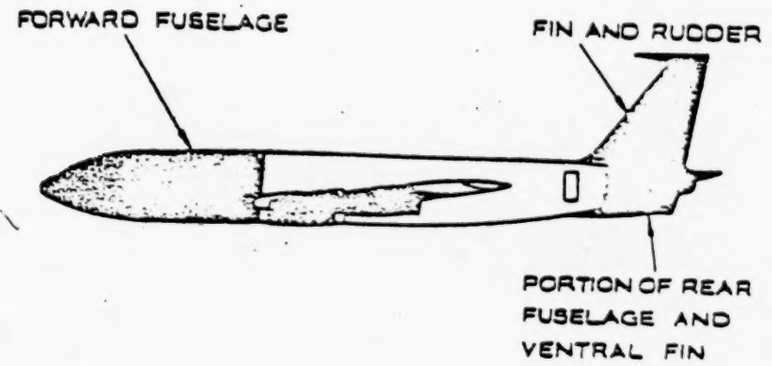
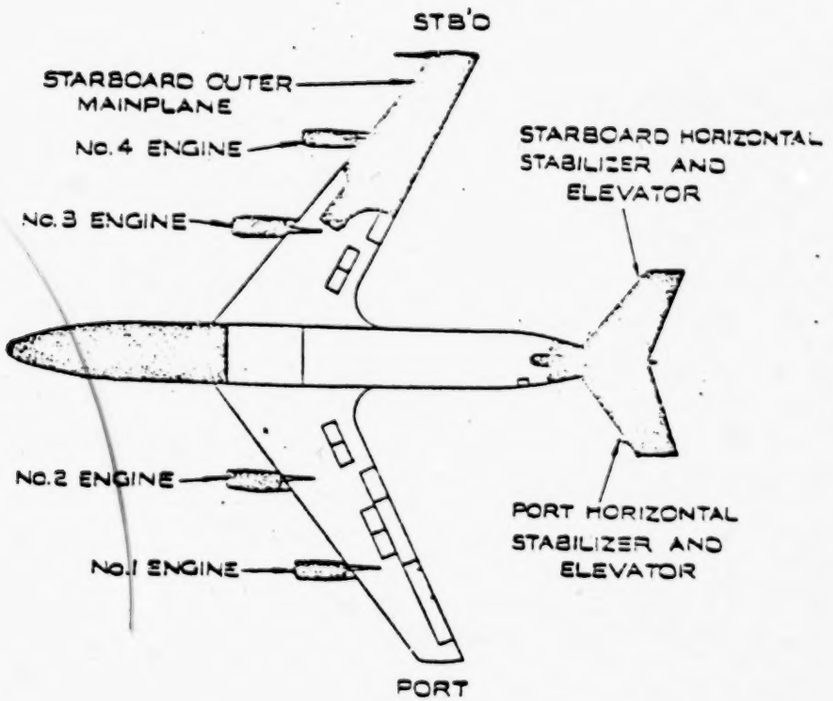
Boeing Exhibit No. D-6

SME-18995/R

Fig.8





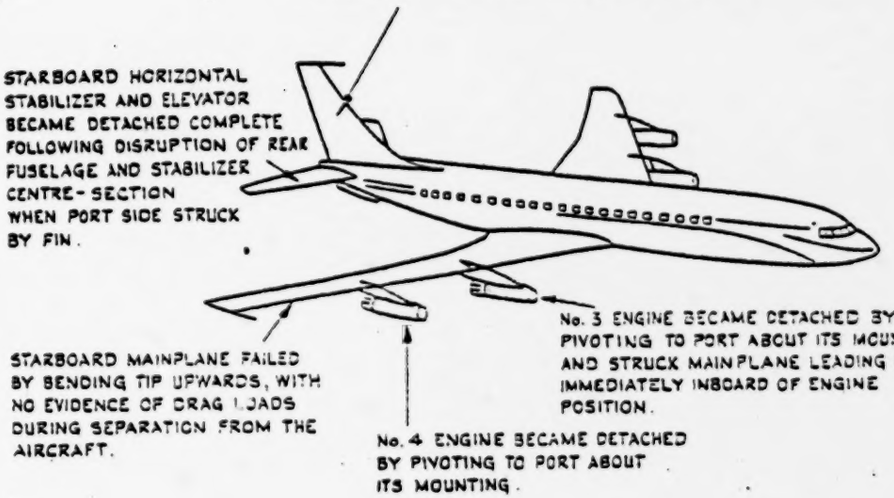
Boeing Exhibit No. D-6

Fig.9

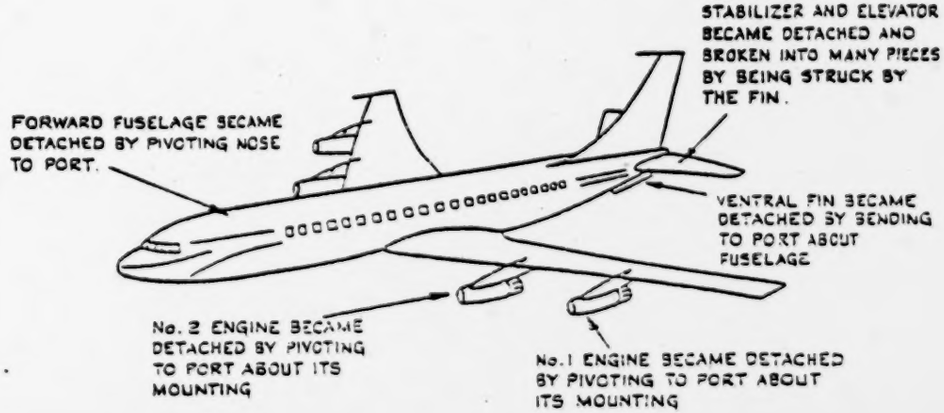
SME 18996/R

LOWER THIRD OF RUDDER BECAME DETACHED (BEFORE FIN FAILED) WHEN RUDDER OVERSWUNG TO PORT FOLLOWING FAILURE OF RUDDER P.C.U. OUTPUT ROD.

FIN AND RUDDER BECAME DETACHED BY BENDING TO PORT ABOUT FUSELAGE AND THEN ROTATING DOWNWARDS TO STRIKE PORT HORIZONTAL STABILIZER.



NO EVIDENCE OF MALFUNCTION WAS SEEN ON ANY COMPONENT EXAMINED

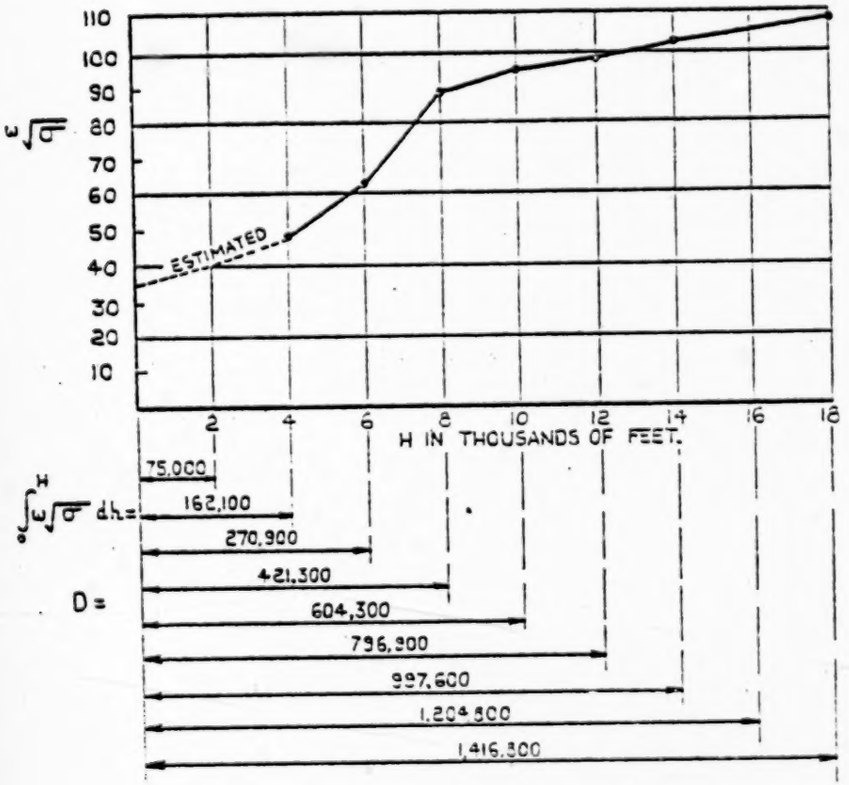


Boeing Exhibit No. D-6

SME 18997/R

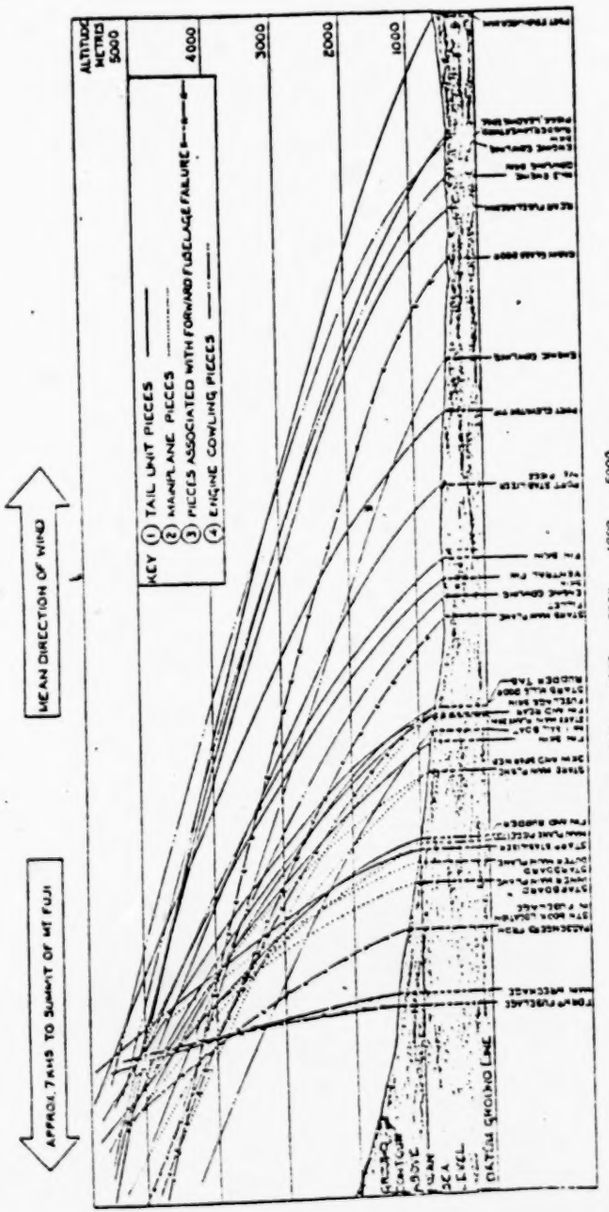
Fig.10

HEIGHT (FEET)	SPEED (KNOTS)	DIRECTION (DEGREES)	W (SPEED) f.p.s.	σ	$\sqrt{\sigma}$	$\omega\sqrt{\sigma}$
18,000	84	300	142	·570	·755	107·2
14,000	75	300	127	·650	·806	102·4
12,000	70	290	118	·693	·833	98·3
10,000	65	280	109·8	·738	·859	94·3
8,000	60	280	100	·786	·887	88·7
6,000	40	280	67·5	·836	·914	61·7
4,000	30	280	50	·888	·942	47·1



$$\text{DRIFT} = \frac{\text{VALUES OF D ABOVE . (FOR SPECIFIC HEIGHTS)}}{\text{TERMINAL VELOCITY OF PARTICULAR PIECE}}$$

Boeing Exhibit No. D-6



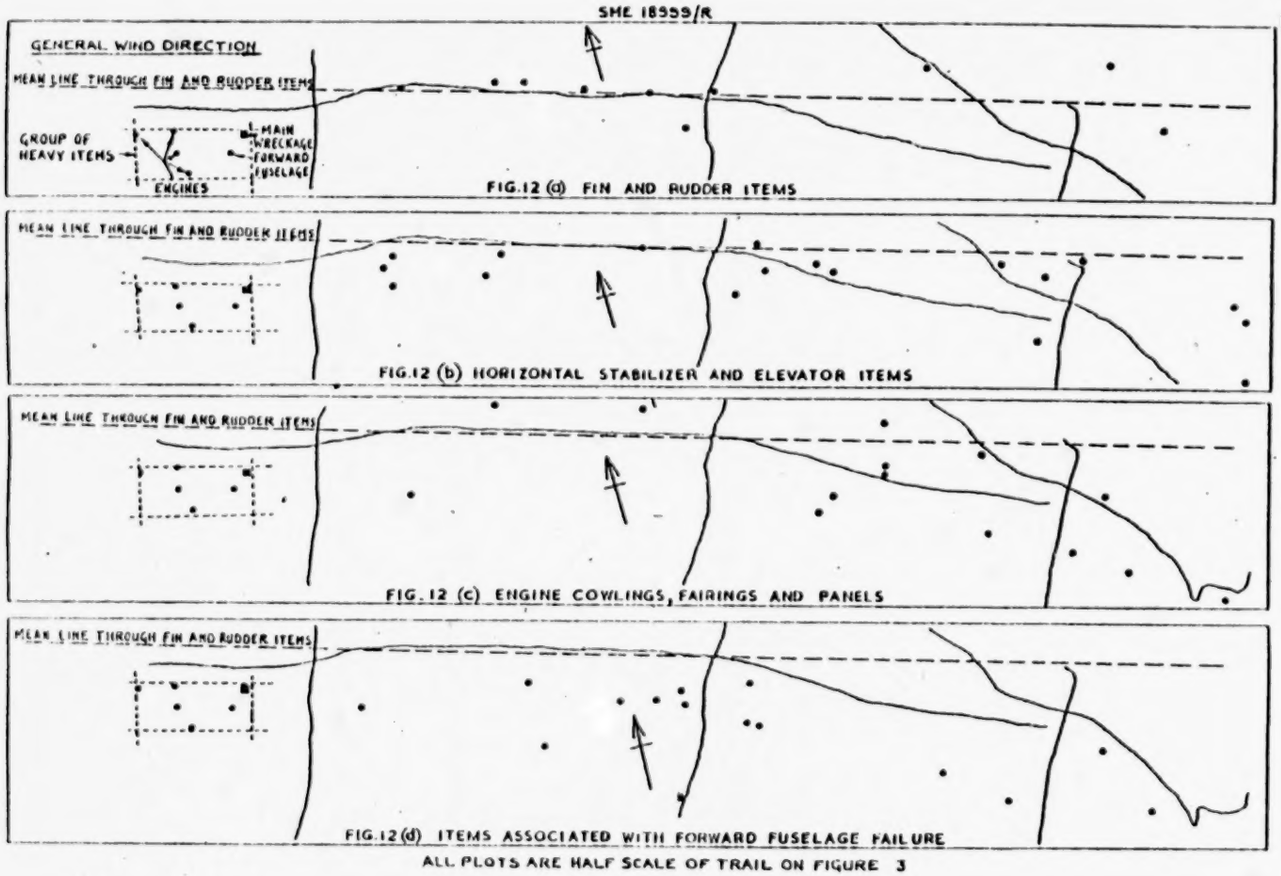
SME 18998/R

Fig.11

FIG 11 WIND DRIFT TRAJECTORIES

SME 18559/R

Fig12



ALL PLOTS ARE HALF SCALE OF TRAIL ON FIGURE 3

FIG. 12 ANALYSIS OF PLANFORM DISTRIBUTION OF WRECKAGE

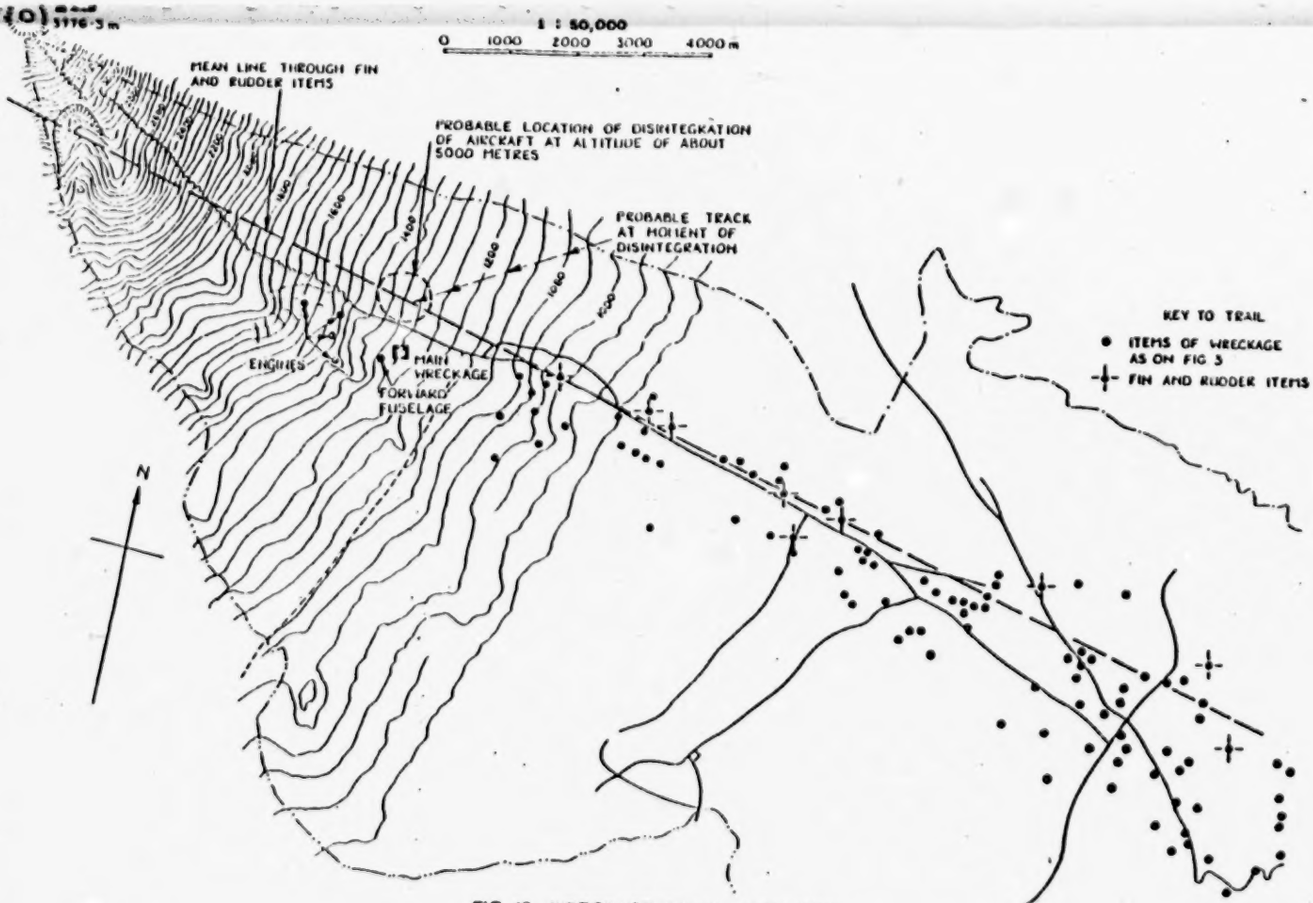
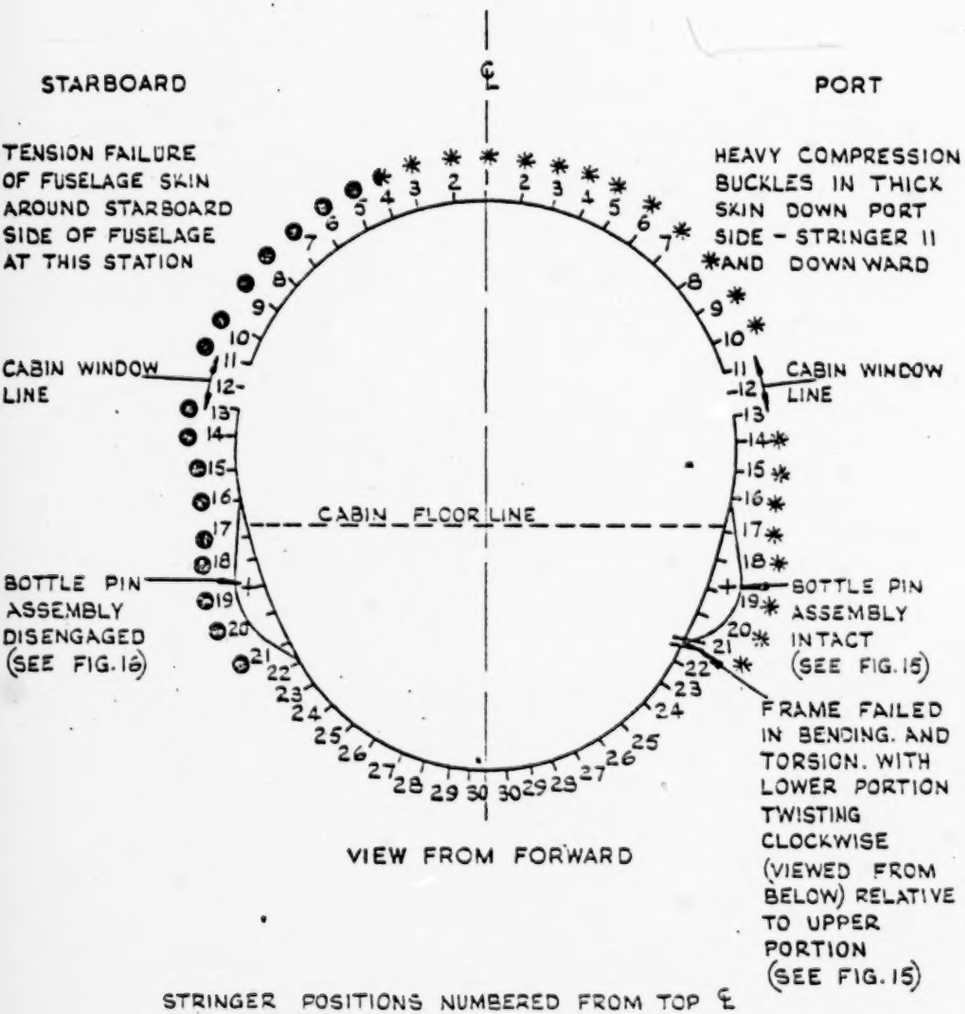


FIG. 13 WRECKAGE TRAIL ANALYSIS

011 900880

Fig.14

FUSELAGE SKIN AND STRINGER FAILURES COLLECTIVELY INDICATE BENDING OF FORWARD FUSELAGE TO PORT, ABOUT STN - 600 K.



STRINGER POSITIONS NUMBERED FROM TOP ℄ DOWNWARDS TO PORT AND STARBOARD

* STRINGERS FAILED IN COMPRESSION

● STRINGERS FAILED IN TENSION

399

FIG. 14 FUSELAGE FAILURE AT STATION 600 K

Fig.15

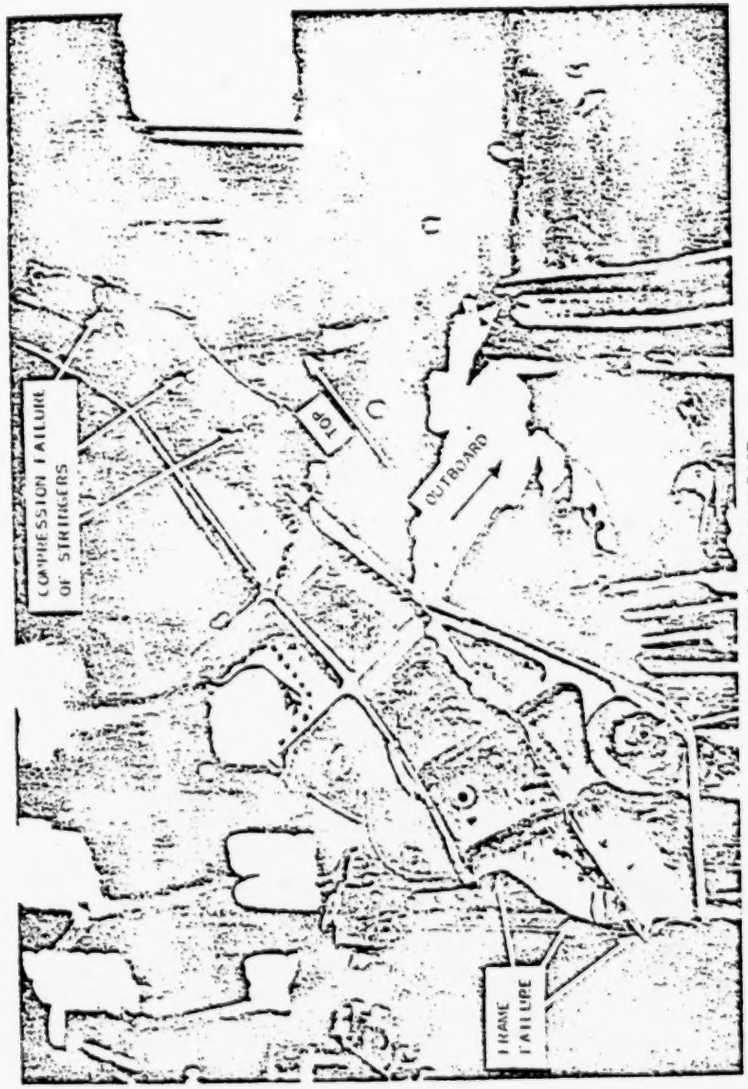


FIG.15 FUSELAGE SEPARATION ON PORT SIDE OF STN. 600K.
'BOTTLE PIN' JOINT INTACT.
VIEW FROM FORWARD

450

Fig.16

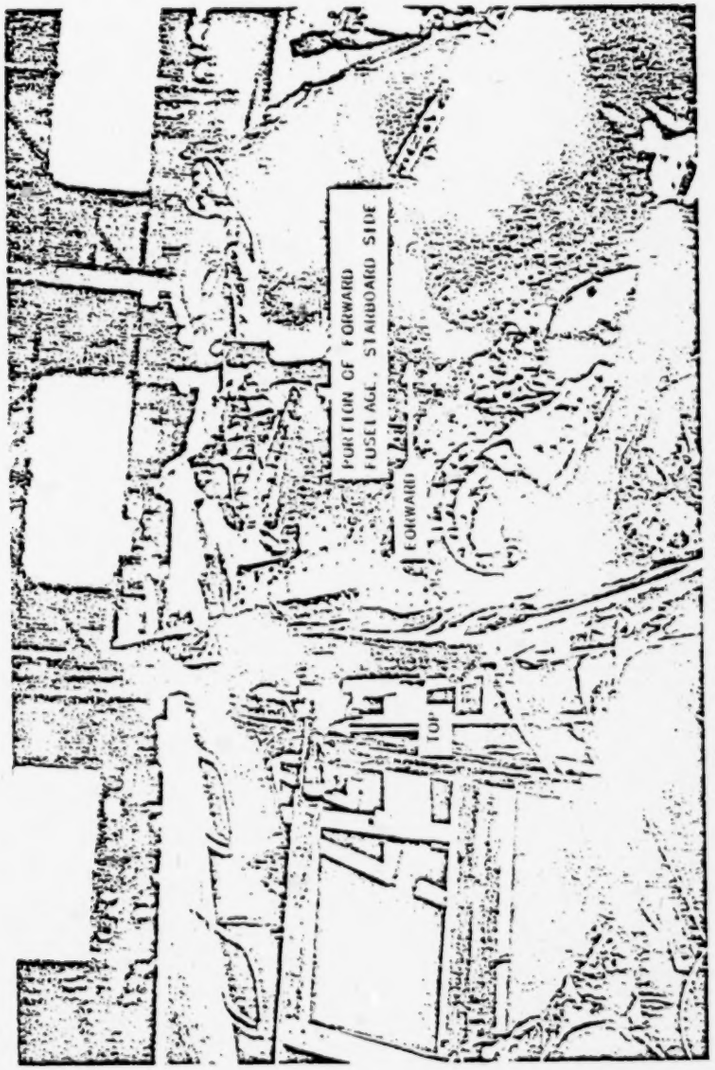
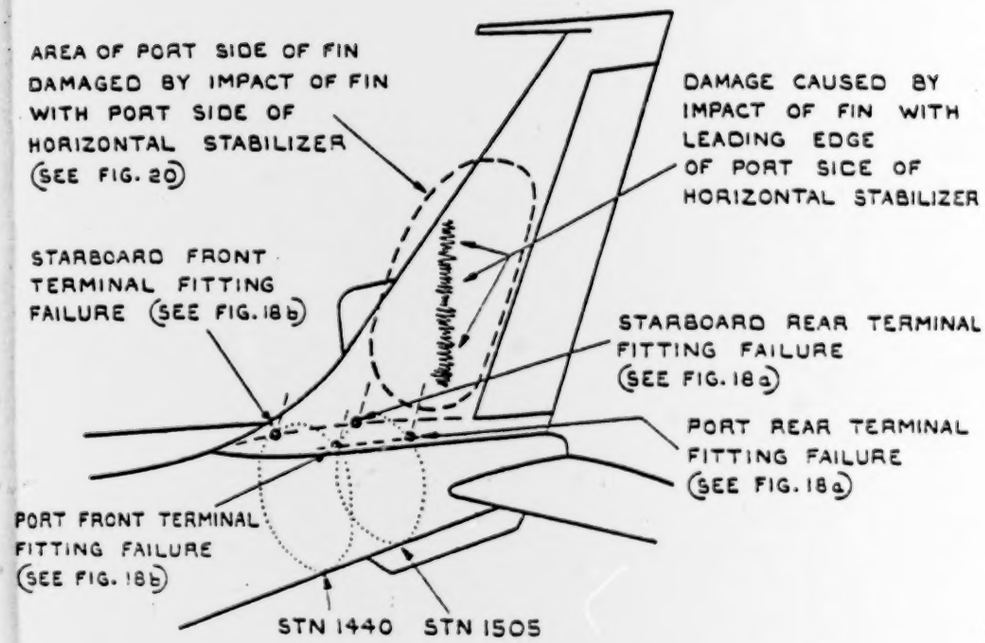
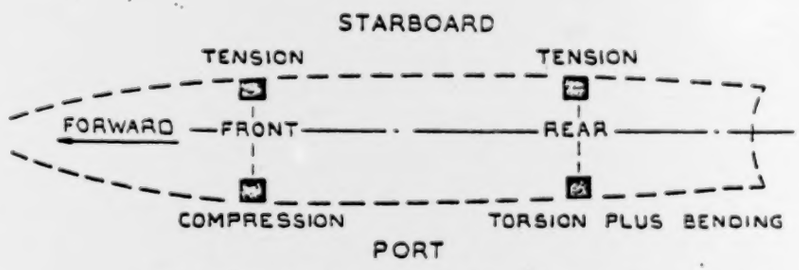


FIG.16 FUSELAGE SEPARATION ON STARBOARD SIDE OF STN. 600K.

Fig.17



FIN BECAME DETACHED BY BENDING TOP TO PORT. ABOUT TERMINAL FITTINGS, AND ROTATED DOWNWARDS TO STRIKE PORT SIDE OF HORIZONTAL STABILIZER.



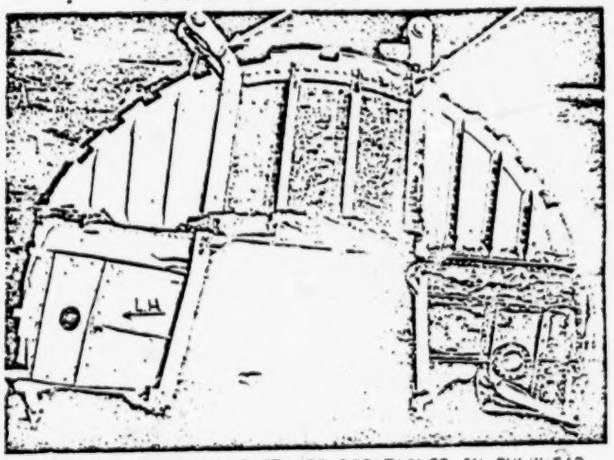
FRACTURES OF TERMINAL FITTINGS

FIG.17 FIN FAILURE

Boeing Exhibit No. D-6

PORT FITTING FRACTURE (TORSION AND BENDING)

STARBOARD FITTING FRACTURE (TENSION)

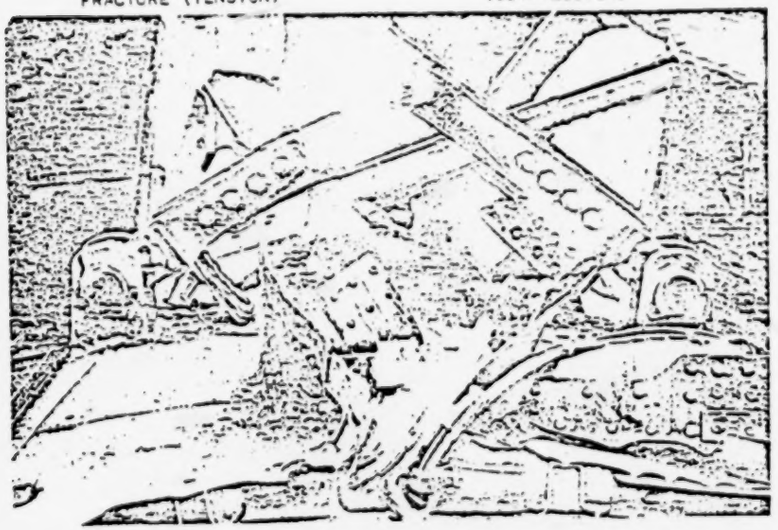


FRACTURED TERMINAL FITTINGS POSITIONED ON BULKHEAD 1505, VIEW FROM REAR

FIG. 18(A)

STARBOARD FITTING FRACTURE (TENSION)

PORT FITTING FAILURE (COMPRESSION)

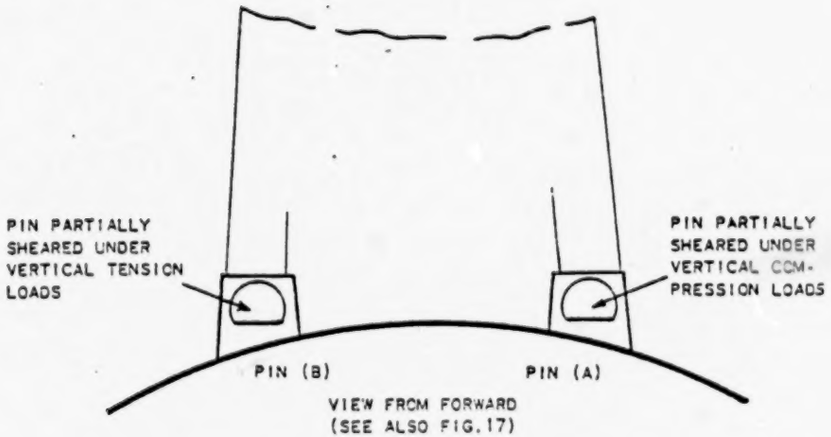


FRACTURED FRONT TERMINAL FITTINGS. VIEW FROM FORWARD

FIG. 18(B)

FIG. 18. FIN TERMINAL FITTING FAILURES

Boeing Exhibit No. D-6



VIEW FROM FORWARD (SEE ALSO FIG. 17)

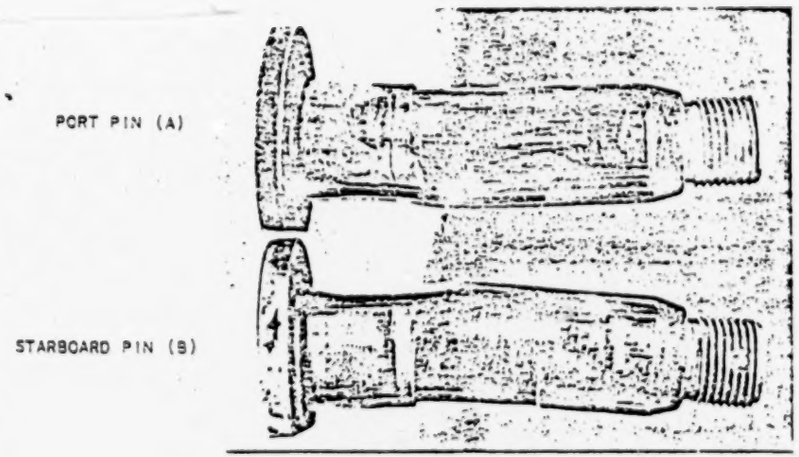
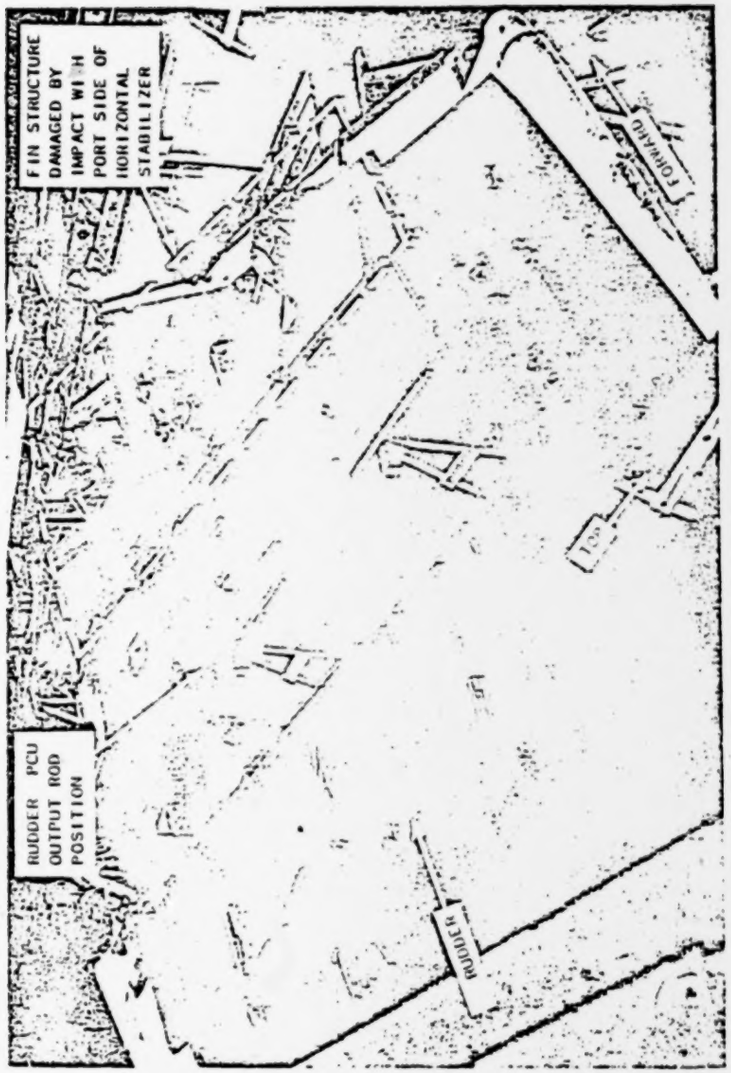


FIG. 19. FRONT TERMINAL FITTINGS - ATTACHMENT PINS IN FIN

T.R. 66322

Fig.20

Boeing Exhibit No. D-6



WRECKAGE POSITIONED WITH PORT SIDE UPPERMOST

FIG.20. FIN AND RUDDER WRECKAGE

Fig.21

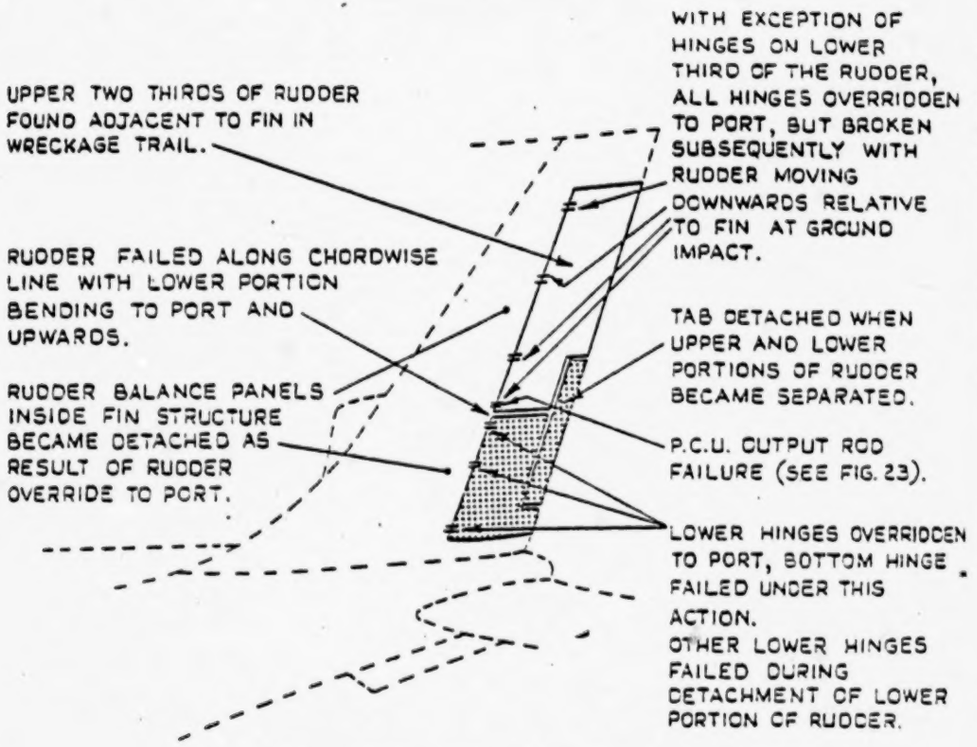
Boeing Exhibit No. D-6

PARTIAL RECONSTRUCTION, SHOWING CENTRAL PORTION DISRUPTION FOLLOWING IMPACT BY FIN

FIG.21. PORT SIDE OF HORIZONTAL STABILIZER

Boeing Exhibit No. D-6

Fig.22



SEQUENCE OF RUDDER DETACHMENT

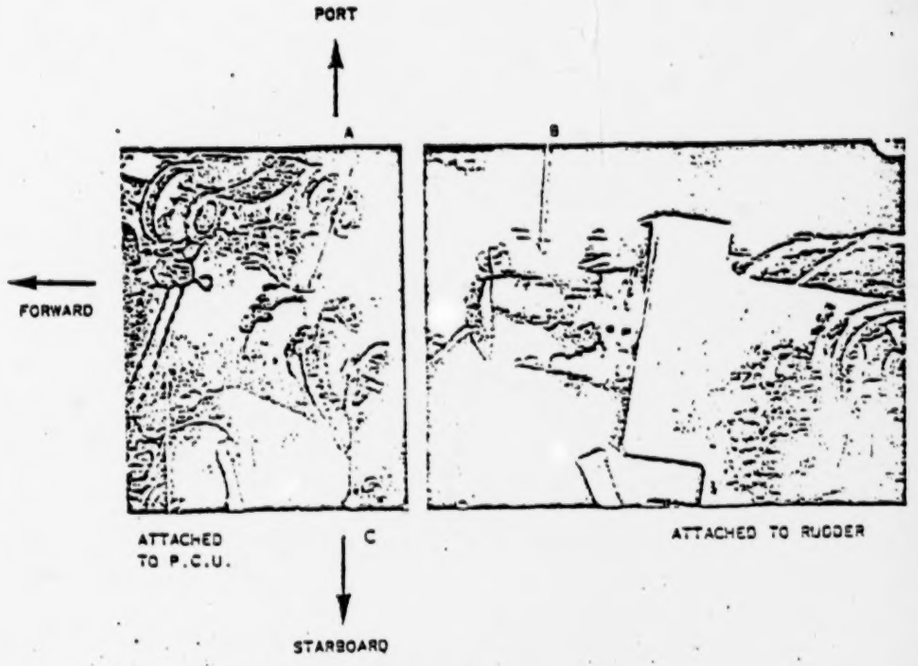
1. OVERRIDE TO PORT OF COMPLETE RUDDER, DAMAGING HINGES.
2. FAILURE OF BOTTOM HINGES BY THE OVERRIDE ACTION.
3. FAILURE OF LOWER RUDDER PORTION BY BENDING TO PORT AND UPWARDS, BREAKING ADJACENT HINGE IN TORSION THEREBY CAUSING DETACHMENT OF LOWER PORTION OF RUDDER.
4. RUDDER TAB BECAME DETACHED IN CONSEQUENCE OF RUDDER FAILURE.
5. RUDDER BECAME COMPLETELY DETACHED FROM FIN AT GROUND IMPACT.

LOWER PORTION OF RUDDER FOUND 1500 m TO EAST OF FIN AND RUDDER IN WRECKAGE TRAIL.

FIG 22 RUDDER FAILURE

Boeing Exhibit No. D-6

Fig.23



VIEW OF BROKEN ROD FROM BELOW

ROD FAILED BY INSTABILITY DUE TO END COMPRESSION LOADS, AND BOWED CENTRE OUTWARDS TO STARBOARD. COMPRESSION BUCKLES FORMING ON PORT SIDE AT A AND B. FRONT PORTION OF FRACTURE WRAPPED OVER END OF JACK ROD AT C, WHEN JACK ROD AT A POSITION EQUIVALENT TO A RUDDER ANGLE OF 5°.42' TO PORT.

FIG.23. RUDDER P.C.U. OUTPUT ROD FAILURE

T.A. 46322

001-900883

Fig.24

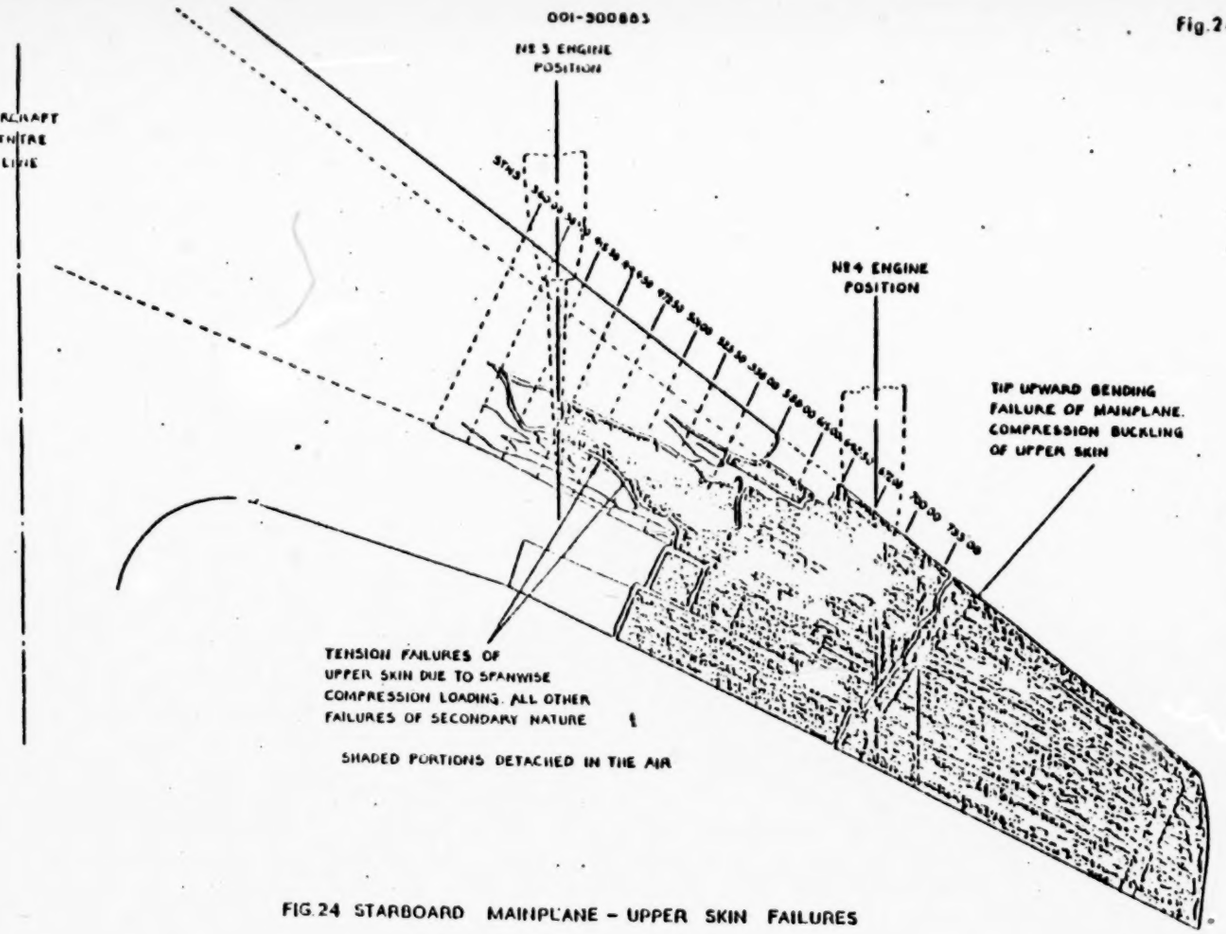


FIG.24 STARBOARD MAINPLANE - UPPER SKIN FAILURES

Fig.25

001-900884

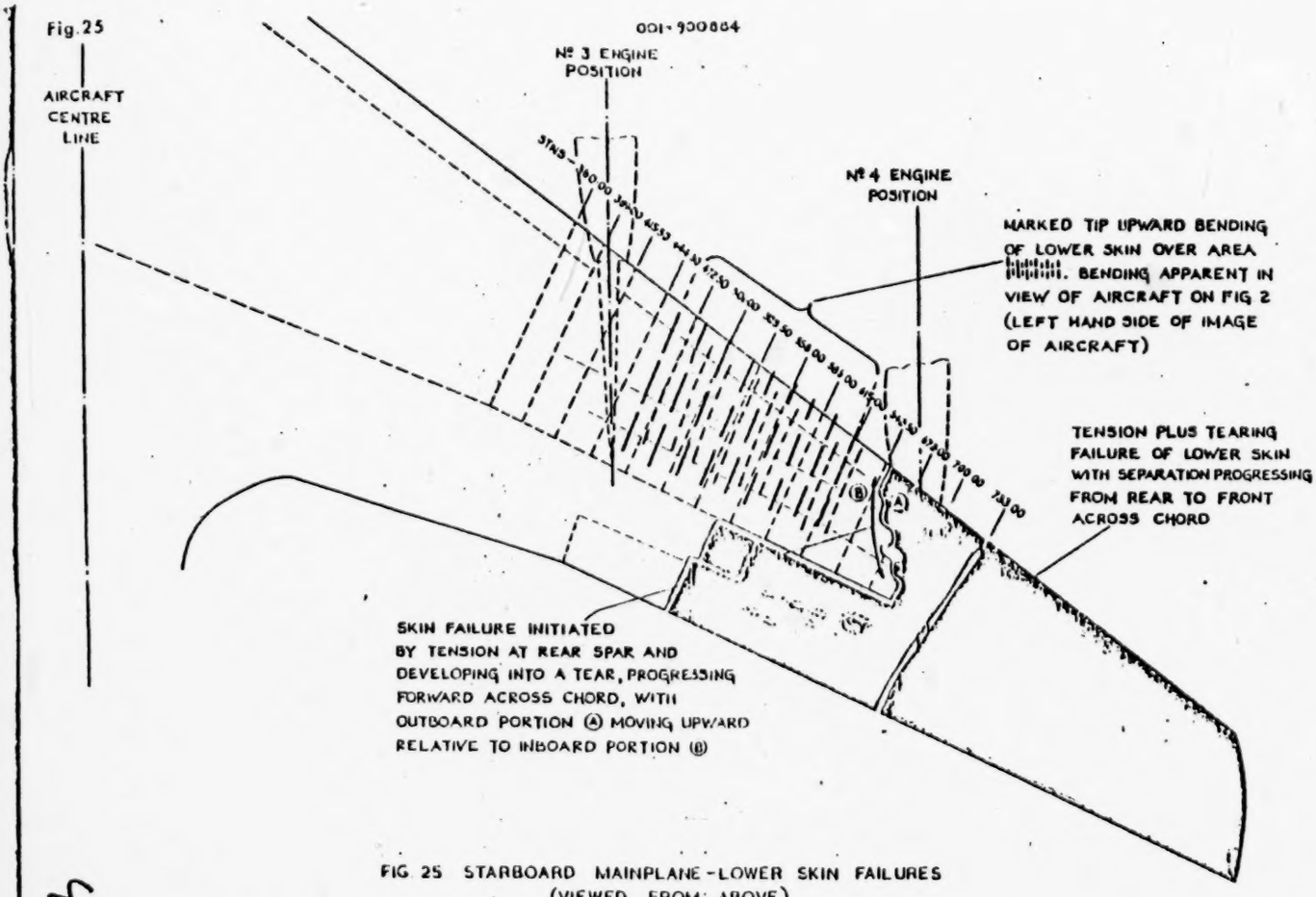


FIG. 25 STARBOARD MAINPLANE - LOWER SKIN FAILURES
(VIEWED FROM ABOVE)

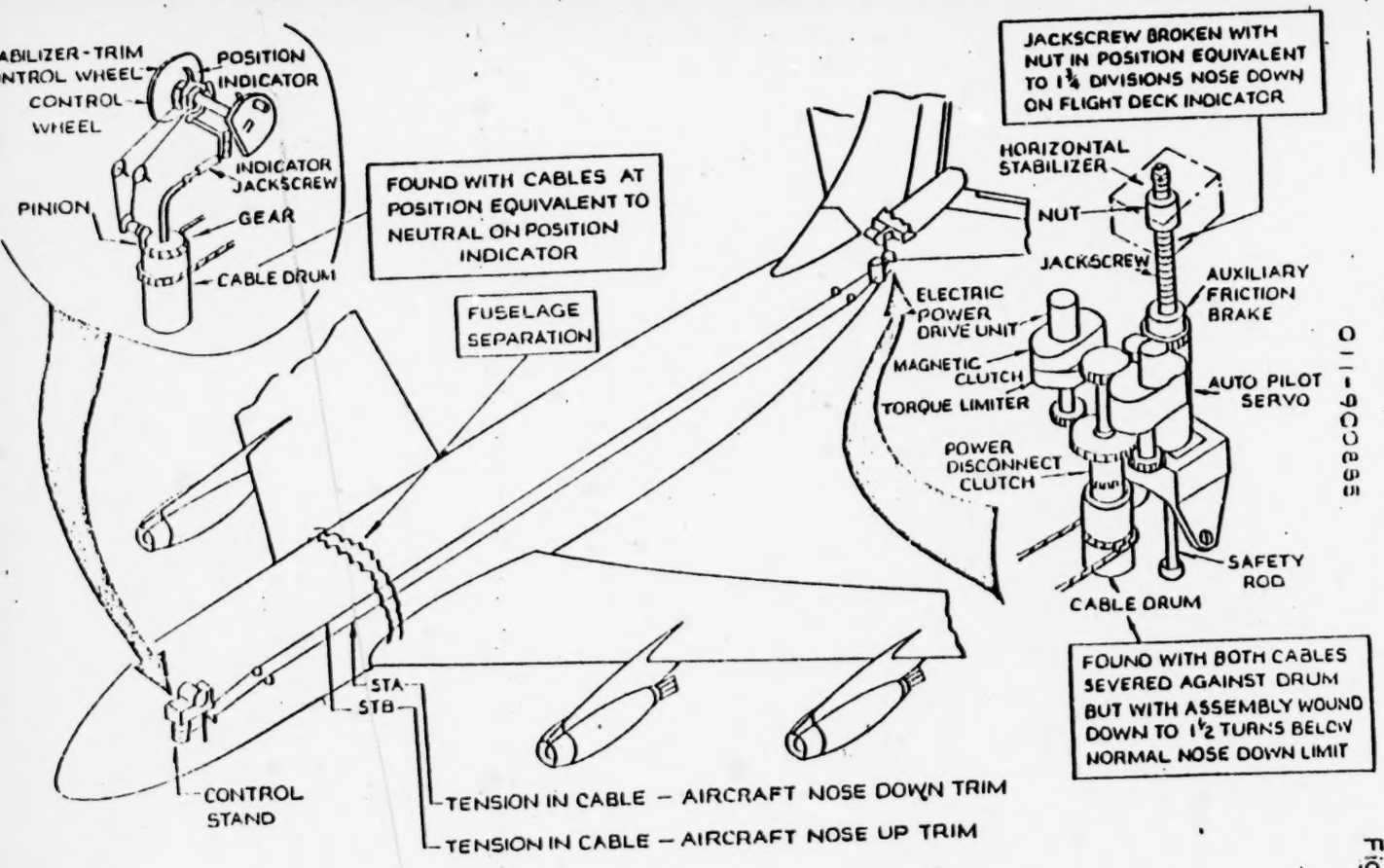


FIG.26 HORIZONTAL STABILIZER TRIM CONTROL SYSTEM

411

Fig.26

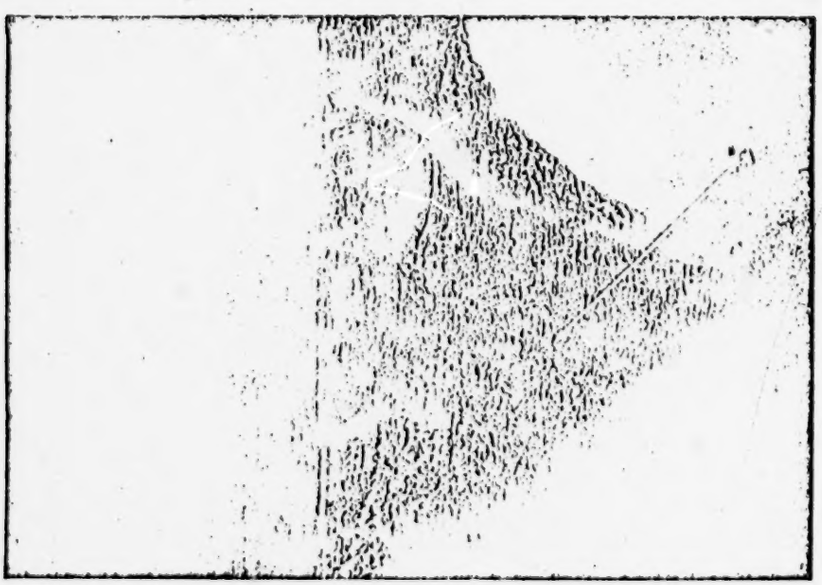


FIG.28 x15

FIG.27 x9

412

Fig.27&28

FIG.29 x11

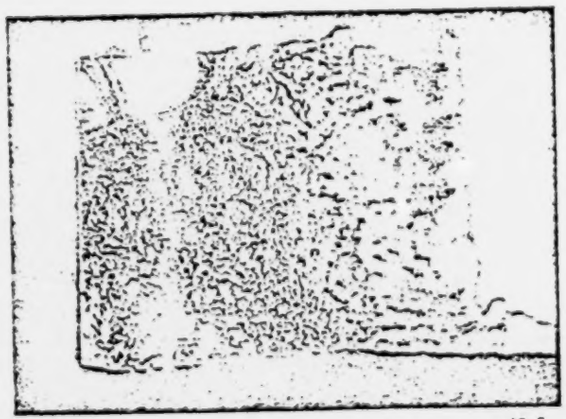
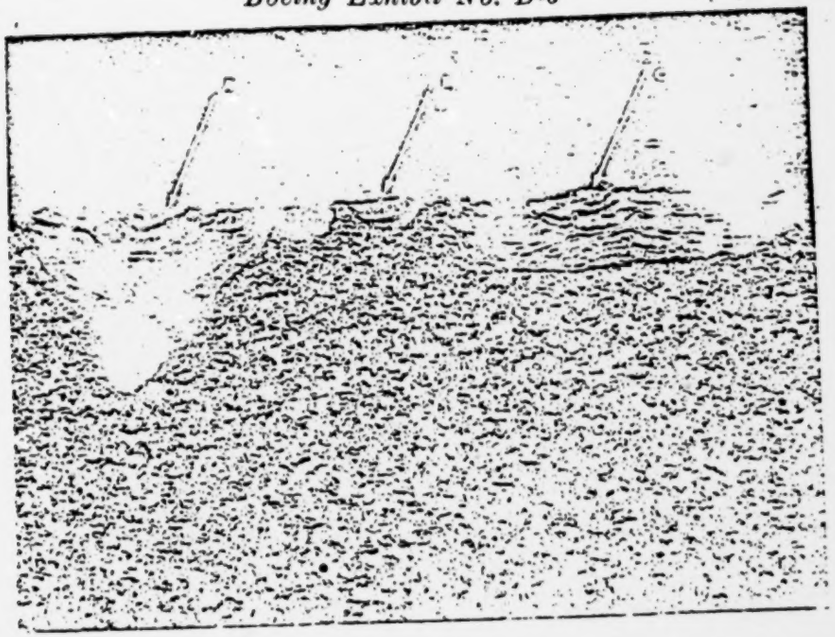


FIG.30 x12.5

FIG.31 x16

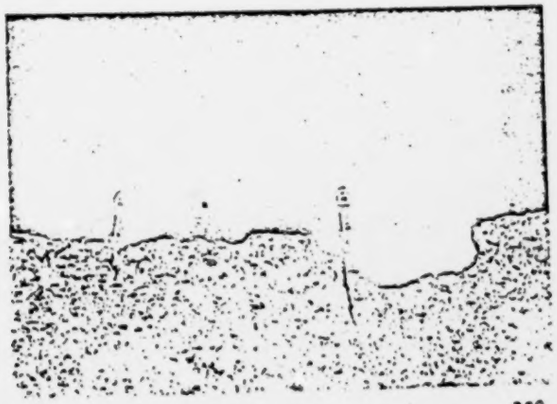
Boeing Exhibit No. D-6

Fig.32&33



x250

FIG.32



x200

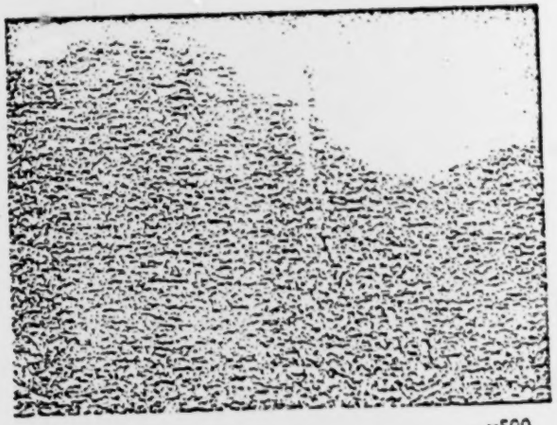
FIG.33

Boeing Exhibit No. D-6

Fig.34&35

x500

FIG.34



x500

FIG.35

Fig.36&37

Boeing Exhibit No. D-6

FIG.36 ×400

FIG.37 ×480

Fig.38&39

Boeing Exhibit No. D-6

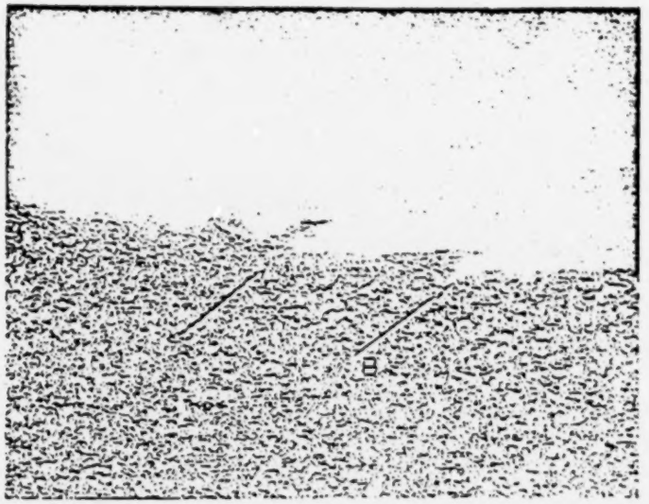


FIG.38 ×400

FIG.39 ×750

Boeing Exhibit No. D-6

FIG.40 x250

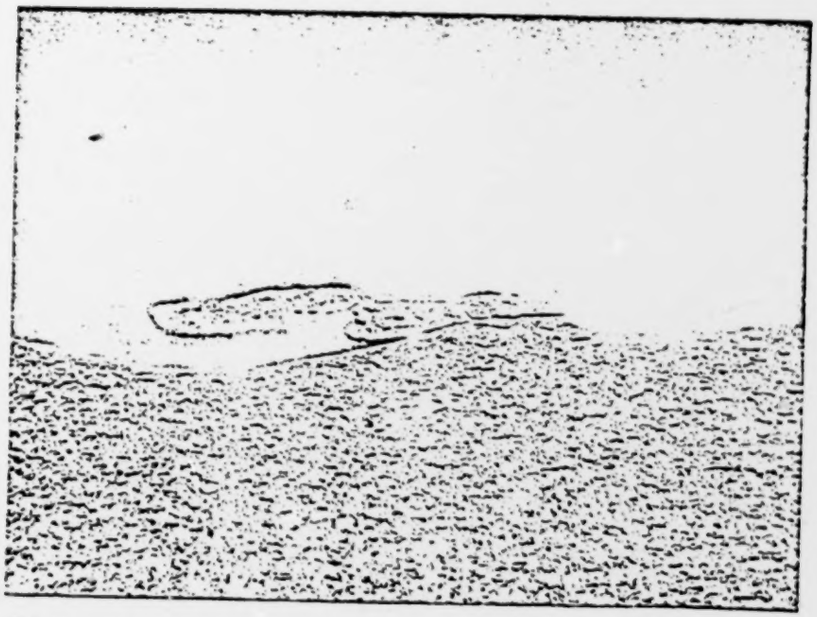


FIG.41 x700

Boeing Exhibit No. D-6

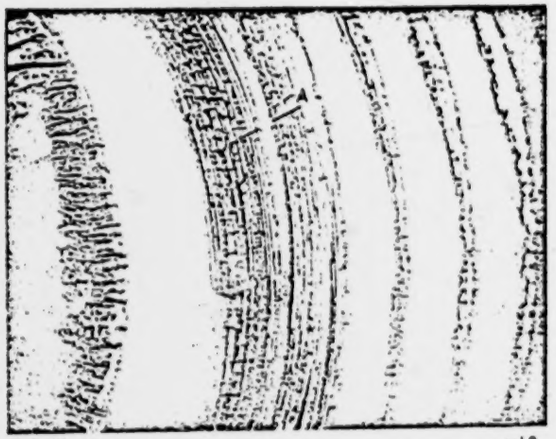


FIG.42 x10

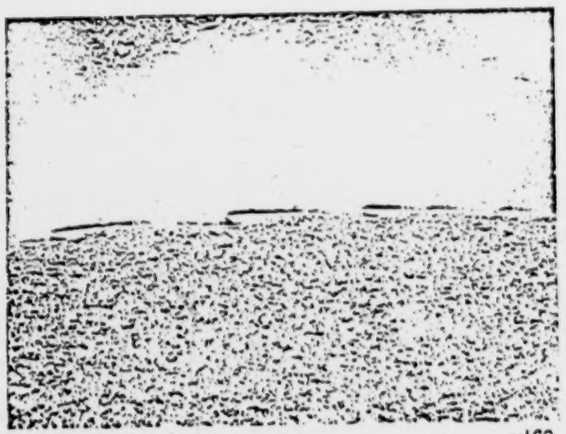


FIG.43 x100

Fig.44&45

FIG.44 x500

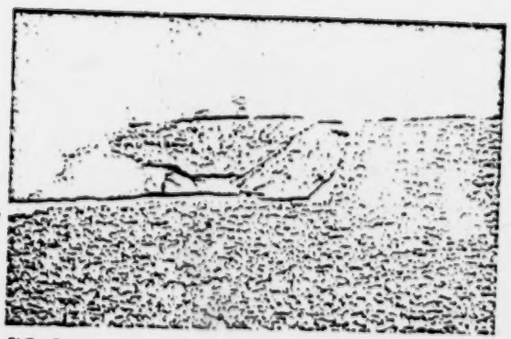


FIG.45 x500

421

Appendix C

ANALYSIS OF WRECKAGE DISTRIBUTION AT ACCIDENT SITE
(see Section 4)

C.1 *Introduction*

When structural disintegration of an aircraft occurs in in the air the many separate pieces which break away form a trail of wreckage on the ground. Most pieces detaching from an aircraft have a low terminal velocity and hence very soon lose nearly all their velocity relative to the wind. These pieces also quickly reach their terminal velocities of descent under the action of gravity. During descent at their terminal velocities, which are usually between 3 metres/sec and 60 metres/sec with the majority below 15 metres/sec, the pieces drift with the wind. Those pieces with the lower speeds of descent will drift further than the more dense parts which have higher dropping speeds.

It is possible to estimate the approximate trajectories of pieces of wreckage from the weight and size of parts, and meteorological records of the wind speeds at the time. If the trajectories are plotted back from the points on the ground where the parts are found, they may give an indication of the height at which the aircraft broke, and possibly help in deciding the order in which the various components of the aircraft became detached.

This technique is described briefly in the ICAO Manual of Aircraft Accident Investigation, 3rd Edition, 1959.

C.2 *Wind drift trajectories for pieces of 707, G-APFE*

The methods referred to above have been used to calculate and plot the trajectories for the pieces of wreckage

found scattered after the accident to 707 G-APFE. Wind data is shown on Fig. 10, and trajectories on Fig. 11.

It is concluded from the trajectories that the aircraft probably disintegrated at an altitude of about 500 metres, and that much of the disintegration was virtually instantaneous, with no particular component becoming detached markedly in advance of all the others.

C.3 *Analysis of planform distribution of wreckage*

The track of the aircraft at the time of the accident is not known with sufficient accuracy, from witnesses, to enable "throw" corrections to be applied to the trajectories

on Fig. 11. However, a study of the planform of the wreckage distribution in the trail enabled the approximate track to be determined.

Using the trail as shown on Fig. 3, the pieces of wreckage from the fin and rudder were plotted out separately as another trail, (Fig. 12(a)) and it was found that they all were approximately on the same straight line which was along the general wind direction. The fin and rudder trail extended over about 8 kilometres of country, and distribution along the trail was compatible with it being only the product of wind drift, i.e. heavy and dense items at the western, or upwind end, and the light items to the east. All of the trail was to the north and east of the group of heavy wreckage items made of engines, main wreckage and forward fuselage.

An extension of the line through the trail of fin and rudder pieces, passed approximately ¾ kilometre to the north of the group of heavy items. It is most likely that all of these pieces of fin and rudder became detached from the

aircraft when it was somewhere along that line, and that the lack of "width" to the trail suggests either almost simultaneous detachment of all items, or that the aircraft track was coincident with the general wind direction. The latter condition cannot apply, since no heavy items of other wreckage (engines, forward fuselage, etc.) are along the line, and their displacement to the south can only indicate that the aircraft track was across the wind direction. The pieces of the horizontal stabilizer and elevators, were also plotted as a separate trail (Fig. 12(b)), and their dispositions, relative to the group of heavy items, and the mean line through the fin and rudder items, was studied. The pieces were all to the south of the line, and generally to the north of the heavy items.

Since all of the tail unit items were less dense than the items in the "heavy group", and also the general distribution, in terms of denseness (or terminal velocity) shows that the heavy items were to the south, and therefore across the general wind line, from the tail pieces, it follows that the aircraft must have had a southerly component in its heading, for the wreckage to have been distributed as found after the accident.

The examination of the wreckage had shown that all engines had become detached in a common manner, and hence it is likely, at the same time. Nos. 1, 2 and 4 engines fell near to each other, but No. 3 was slightly to the west of the other engines.

It was established (A. 3) that No. 3 engine had struck the mainplane during its separation from the aircraft and it is thought probable that this impact introduced a factor which modified the flight path of this engine. During its detachment, and impact with the mainplane, No. 3 engine shed much of its cowlings and fairings. These items were

Boeing Exhibit No. D-6

found scattered along the wreckage trail and a separate plot was made (Fig. 12(c)), as for the tail pieces.

A separate plot was also made of all the pieces of wreckage associated with the forward fuselage failure, and of the passengers, found away from both the forward fuselage and the main wreckage. An analysis of this plot tended to confirm that the fuselage failure must have followed that of the fin and rudder, since all of these items were to the south of the items of the fin and rudder in the trail.

It is concluded from the study of the planform of the distribution of the wreckage, and the analysis of the trajectories of the falling pieces, that:—

(a) The aircraft disintegrated at an altitude of about 5000 metres.

(b) The aircraft was on a track to the south of west at the instant of disintegration and was approximately 7 kilometres to the south-east of Mt. Fuji (Fig. 13).

(c) Much of the disintegration was virtually instantaneous, and no component became detached markedly in advance of all the others.

Boeing Exhibit No. D-7

(Article entitled "Peel-Off Turbulence" in *BOAC Air Safety Review* December, 1970)

PEEL-OFF TURBULENCE

The following item from the Japanese National Meteorological Institute is reproduced for information. Meteorological Superintendent has indicated that it is "provisional" in nature but Aeronautical Information Circular 7/1968 makes it clear that rotor turbulence can produce vertical velocities of up to ± 100 ft/sec. These can cause structural damage and may even break up an aircraft. Obviously the theory and the general rules laid down in the penultimate paragraph could also apply to any isolated peaks of the same order of magnitude.

A mysterious air turbulence has proved to be the cause of the crash of the BOAC Boeing 707 jetliner on March 6 1966, near Mt Fuji, in which 124 crew members and passengers perished. Dr Seiji Sohma, chief of the First Research Division, the Physiometeorological Research Department, the National Meteorological Institute, has conducted researches on the air turbulence since the air disaster.

Dr Sohma, as a result, has recently found that the clear air turbulence could be caused by a peculiar air flow, which he has called "peel-off" near the summit of Mt Fuji. The 53 year old researcher says that the "peel-off" turbulence is more severe than air turbulence within cumulonimbus which aircraft have been told never to enter. It is only natural he says, that the BOAC jetliner was instantly destroyed when it flew into the "peel-off" turbulence.

The BOAC disaster four years ago came as a heavy shock to meteorologists as well. To them, it presented a ques-

tion, "Does an unknown air turbulence, severe enough to disintegrate a jet plane, exist?" After the mishap, Dr. Sohma was ordered by Dr. Tohei Ohtani, the then director of the NMI, to solve this question.

At the time, it was simply conceived that the air turbulence around Mt Fuji was the mountain wave, a kind of ascending air flow being spread out like waves in the lee side of Mt Fuji. This was the finding of mountain air current research programmes conducted by foreign scientists.

But much remained to be solved according to this mountain wave theory, because Mt Fuji is a solitary peak, and not a mountain range. Dr Sohma then carried out a series of wind tunnel tests and obtained proof that this strange phenomenon—"peel-off" turbulence—could arise around a solitary mountain like Mt Fuji.

In winter, strong westerly winds blow against the slope of Mt Fuji and pass over the mountain after hitting the top. At this moment, a strong air flow develops on the lee side of the mountain and blows up along the slope toward the summit ("peel-off" phenomenon). This strong air current blowing upwards causes numerous vortices to develop east of the mountain top. This clear air turbulence is peculiar to the 3776 metre high peak.

Dr Sohma has devoted the past three years to confirming this phenomenon through various observation experiments. For example, a parachute with flash-bulbs was dropped from a plane at dusk on the west side of Mt Fuji and observations were made on how the parachute drifted. Another test involved the photographing of flying balloons with a 16mm camera.

Through such tests the real character of the air turbulence around the solitary mountain of Fuji has come to light.

The turbulence arises in an area 1 km wide and 15-20 km long, east of the mountain summit, when strong westerly winds of more than 25 metres per second blow (about 50 knots). And the turbulence is the severest ever observed by meteorologists.

Winds of about 35 metres per second are said to have been raging near the top of Mt Fuji when the BOAC jetliner crashed around 2.15 pm on March 5, 1966. It can be theorised, therefore, that the plane disintegrated instantaneously as it was engulfed into the air turbulence caused by the "peel-off" phenomenon near the summit.

In view of this finding, Dr Sohma says "on clear winter days, aircraft flying close to Mt Fuji should steer clear of an area stretching at an angle of 60 degrees from the top (or 30 degrees on both sides of the line extending due east from the top or along the wing line), and also should keep at least 20 km away from the summit. They are also advised to fly "at an altitude of more than 5000 metres near the mountain".

Dr Sohma is expected to publish a report on "research on air turbulence affecting the flight safety of aircraft" at a meeting of the Japan Meteorological Society scheduled for autumn 1970.

Boeing Exhibit No. D-8

(Affidavit of Howard W. Smith)

UNITED STATES DISTRICT COURT

WESTERN DISTRICT OF WASHINGTON

Nos. C74-257S and C74-380S

BRITISH OVERSEAS AIRWAYS CORPORATION,

Plaintiff,

vs.

THE BOEING COMPANY,

Defendant.

AFFIDAVIT OF HOWARD W. SMITH IN SUPPORT OF BOEING'S MOTION FOR SUMMARY JUDGMENT

STATE OF WASHINGTON,
COUNTY OF KING, *ss.*

I, HOWARD W. SMITH, being duly sworn, depose and say:

1. I am Chief of Structures Research in the Structures Technology Staff of Boeing Commercial Airplane Company, and have held that position for approximately three years. In that position I manage the independent research and development activities of the structures staff at Boeing. I have been employed continuously for more than 35 years for Boeing, principally as an aeronautical engineer with a specialty in structures.

2. I have reviewed the BOAC Incident/Accident Report No. 558 prepared by British Overseas Airways Corporation. According to that report the following major, in-flight failures occurred to G-APFE:

Boeing Exhibit No. D-8

(a) The right wing of G-APFE experienced severe and sudden upward loading and failed upwards both outboard and inboard of the No. 4 engine;

(b) The forward fuselage broke away to the left of the aircraft and downward;

(c) All four engines failed to the left of the aircraft and downward;

(d) The vertical fin failed to the left and struck the left horizontal stabilizer;

(e) The left horizontal stabilizer failed as well as the remainder of the empennage.

3. I have reviewed the above-listed failures in the context of basic aerodynamic principles, the structural strength of the aircraft components and the performance characteristics of the 707 aircraft. In my opinion, G-APFE encountered wind gust loading in excess of the loads the aircraft was designed to withstand. Accordingly, the aircraft would have broken up whether or not there was a crack in its right fin attachment fitting and the crack in the fitting is irrelevant to the cause of the accident.

/s/ HOWARD W. SMITH
Howard W. Smith

SUBSCRIBED AND SWORN TO before me this 14th day of August, 1976.

/s/ (Illegible)
Notary Public in and for the State of Washington, residing at Seattle

Boeing Exhibit No. D-9

(Affidavit of John D. Dillow, Esq.)

UNITED STATES DISTRICT COURT

WESTERN DISTRICT OF WASHINGTON AT SEATTLE

Nos. C74-257S and C74-380S

BRITISH OVERSEAS AIRWAYS CORPORATION,

Plaintiff,

vs.

THE BOEING COMPANY,

Defendant.

AFFIDAVIT OF JOHN D. DILLOW IN SUPPORT OF BOEING'S MOTION FOR SUMMARY JUDGMENT

STATE OF WASHINGTON,
COUNTY OF KING, *ss.*

John D. Dillow, being duly sworn, deposes and says:

1. I am associated with the law firm of Perkins, Coie, Stone, Olsen & Williams, counsel for defendant The Boeing Company ("Boeing") in this action. In the period from July 19 through July 30, 1976, in London, England, counsel for Boeing took the depositions of present and former BOAC employees who had knowledge relating to the G-APFE accident. Keith Gerrard and I took those depositions on behalf of Boeing. At this time, transcripts of those depositions are not yet available. The court reporting firm which transcribed those depositions has informed me that transcripts should be available on or about September 1, 1976. However, I took detailed notes of the

Boeing Exhibit D-9

deponents' testimony and submit this affidavit as evidence thereof. Upon receipt of the deposition transcripts, we will submit those transcripts to the Court.

2. On Friday, July 30, 1976, Boeing deposed John R. Boulding. At the time of the G-APFE accident in March, 1966, Mr. Boulding was Deputy Chief Inspector of Accidents at BOAC. Shortly thereafter, in November, 1966, Mr. Boulding became Chief Inspector of Accidents for BOAC and has held that position continuously up to and including the present. The branch which Mr. Boulding headed, the Accident Investigations Branch, was in charge of all incident and accident investigations involving BOAC aircraft and was charged with submitting monthly reports for those accidents to BOAC's Air Safety Committee. Mr. Boulding went to Japan in March of 1966 and participated in the accident investigation on behalf of BOAC.

3. Mr. Boulding testified that as Chief Inspector of Accidents, he prepared BOAC Incident/Accident Report No. 558 (Boeing Exhibit D-1) and submitted that report to BOAC's Air Safety Committee with the recommendation that the accident file be closed. That recommendation was accepted by the Air Safety Committee; Mr. Boulding's report was published in BOAC's Air Safety Review dated August, 1967, and the accident file was closed. The BOAC Air Safety Review was, and still is, circulated to all BOAC management, captains and flight crews and to persons and entities outside of BOAC. Boulding further testified that in July of 1967, he submitted a report on the G-APFE accident to the International Air Transport Association pursuant to that organization's information exchange program. Thereafter, IATA circulated Mr. Boulding's ac-

cident report to its member airlines around the world. A copy of that report is Boeing's Exhibit D-5.

4. Mr. Boulding was specifically referred by Boeing's defense counsel to the following statement in his Accident Report No. 558 at page 5:

> "The fin fitting was released to Boeing for detailed metallurgical examination and they concluded that these cracks were not an accident cause factor."

Mr. Boulding testified that he did not disagree with Boeing's conclusion, and that he knew of no other person who had ever expressed any disagreement with that conclusion. He further testified that he knew of no document that expressed any disagreement with that conclusion.

5. On Monday, Tuesday and Wednesday, July 19, 20 and 21, 1976, Boeing's defense counsel deposed Ben J. Folliard. Mr. Folliard was Chief Inspector of Accidents for BOAC at the time of the G-APFE accident, and retired from that position in November, 1966. During the depositions, counsel for BOAC designated Mr. Folliard as "the officer, director or employee of BOAC, or the former officer, director or employee of BOAC most knowledgeable with regard to the cause of the crash of the Boeing 707 aircraft, registration G-APFE, on or about March 5, 1966" pursuant to the notice of depositions filed by Boeing in this action on June 1, 1976. Mr. Folliard testified that BOAC "accepted" the conclusion as to probable cause of the G-APFE accident reached by the Japanese in its official report.

6. Mr. Folliard further testified that he requested the British Government, specifically its Royal Aircraft Establishment, to send an expert on aircraft investigation to Japan in order to investigate the G-APFE accident. Pursuant to Mr. Folliard's request, the Royal Aircraft Establishment sent F. H. Jones. Thereafter, Mr. Jones issued a report that sets forth his conclusion as to the probable cause of the accident. Said report is Boeing Exhibit D-6.

7. On July 29, 1976, Boeing deposed Captain T. Nisbet. Captain Nisbet is presently Air Safety Advisor and Chairman of British Airways' Air Safety Committee, and has held that position since April of 1976. At the time of the G-APFE accident, Captain Nisbet was General Manager of Flight Operations for BOAC. Captain Nisbet was referred to the following statement in BOAC's Incident/Accident Report No. 558 as follows:

> "The fin fitting was released to Boeing for detailed metallurgical examination and they concluded that these cracks were not an accident cause factor."

Captain Nisbet testified that he did not disagree with Boeing's conclusion and that he knew of no person who had ever expressed any disagreement with that conclusion. He further testified that he knew of no document expressing any disagreement with that conclusion.

/s/ JOHN D. DILLOW
John D. Dillow

SUBSCRIBED AND SWORN TO before me this 14th day of August, 1976.

I. THEODORE THOMSEN
Notary Public in and for the State of Washington, residing at Bellevue.

Boeing Exhibit No. D-10

(BOAC Preliminary Accident Investigation Report, Section 3 Technical Report, dated July 29, 1966)

Section 3

TECHNICAL REPORT

PREFACE

Shortly after take-off from Haneda Airport in daylight and good visibility the aircraft was seen to break up in the air and to fall in numerous pieces on the eastern slopes of Mt Fuji. All 113 passengers and the crew of 11 were killed. There was no fire prior to the breakup but subsequently fire broke out in the forward fuselage.

A passenger on board the aircraft with a movie camera had taken a series of shots during the flight, the last having been taken very shortly before the accident and featuring Lake Yamanaka. Studies of this film have been made by the 101 Recce Btn of the Japanese Self Defence Force and by the Joint Air Recce Intelligence Centre (UK). These studies have resulted in calculated speeds, heights and positions of the aircraft. The Japanese and UK results are different. The Japanese put the aircraft in the vicinity of Gotemba and the UK to the north west of Gotemba when the shots of Lake Yamanaka were taken.

(Gotemba is a small town at the foot of the eastern slopes of Mt Fuji. It is about 80 km west of Haneda Airport and about 20 km from the summit of Fuji. Lake Yamanaka is 13 km to the north north west of Gotemba).

According to eye witnesses the first indication of trouble was when the aircraft was about 6 km west of Gotemba when "white smoke" was seen to be coming from both wing

tips. Times for the appearance of the "white smoke" have been variously given as 0508 hrs 09 seconds, 0512 to 0513 hrs and 0512 hrs 15 seconds.

(The aircraft was airborne from Haneda at 0458 hrs and probably over or abeam Haneda on a westerly heading, following a right hand turn, at about 0502 hrs).

Photographs and a film taken from the ground show that the empennage, the forward part of the fuselage from stn 600 k, the right outer wing (inboard and outboard of No. 4 engine) and all four engines broke away in flight: this was confirmed by the wreckage trail. The wreckage was strewn for a distance of 16 km but most of the main structure and components, including the engines, were found within the final 8 km.

Five of the passengers immediately behind Station 600k, in row 8, the first row of the economy seats on the particular configuration to which the seating conformed, fell out and their bodies were recovered about 1 km before the main wreckage area.

The field examination of the wreckage was carried out between 7.3.66 and 30.3.66 and included:—

(a) Wreckage examination

(b) Preparation of wreckage trail

(c) Photographic recording of wreckage

Item (a) included examination of in-flight fractures by a Boeing metallurgist (H Zahn) who found evidence of a fatigue crack in bolt hole R1 of the fin/fuselage rear right terminal.

On 25.3.66 the Chairman of the Japanese investigation team (Professor T Moriya) permitted the fractured fin/

fuselage rear terminals and the part of bulkhead 1505 to which the terminals are attached to be sent to Boeing for examination.

Boeing issued a report on their examination, ref T6-3577 dated 14.4.66 and the fittings and bulkhead were subsesequently returned to Tokyo.

The Boeing examination included the removal of sections from the right hand terminal for a complete metallurgical examination and fracture analysis. Boeing concluded, inter alia, that "final fracture of the RK fin body terminal fitting initiated at an existing crack in hole R1" and that "the existing crack in hole R1 was a fatigue crack".

These test pieces were brought to UK on 7.5.66 for examination by P Forsythe and A Stubbington of RAE.

There was also evidence of a fatigue crack in No. 1 engine support member on the under surface of the wing but this was not considered relevant to the accident. All other in-flight fracture surfaces were considered to be of the overload type.

Following the field examination of the wreckage it was transferred to Chofu airfield, the transfer being completed by 6.4.66, where it was laid out in a hangar by the Japanese Civil Aviation Bureau personnel. There, examinations were made by F H Jones of the RAE Accidents Section and P H Sandon, of the Structures Department of Boeing.

In addition to the information given above in respect of the in-flight structure fractures, the examination of the wreckage on the site of the accident and at Chofu indicated the following: —

(a) The right wing experienced severe and sudden upward loading and failed upwards both outboard and inboard of the engine.

(b) The fin failed to the left and struck the left horizontal stabilizer causing the break-up of that stabilizer and resulting in the remainder of the empennage breaking away as in (c) below.

(c) The right horizontal stabiliser and centre section broke away in one piece and at this time the horizontal stabilizer was positioned at 1¾ divisions 'aircraft nose down'.

(d) The rudder output rod failed under load applied from the right when the rudder was positioned approximately 5¾° to the left. Subsequently the rudder overrode to the left and then broke into two pieces: one piece, the upper two thirds, remained attached to the fin until ground impact.

(e) All four engines broke away to the left and downwards. No. 3 engine struck the wing just inboard of its position.

(f) The forward fuselage broke away to the left at Station 600k and only this part of the aircraft was burnt.

(g) A SFIM flight recorder which was located in lower 41 hold was destroyed by fire.

(h) No physical evidence was found to determine the sequence of the break-up of the aircraft and the wreckage trail gave no positive indication.

MAIN WRECKAGE

The main wreckage consisted of the main plane from and including the left wing tip through to just inboard of No. 4 engine position and the fuselage from stn 600k (level with the front spar of the main plane) to stn 1505 (just

after the pressure dome). This wreckage had fallen in a wooded area on the eastern slopes of Mt Fuji at a position approximately 12 km west of the town of of Gotemba. The elevation at this point is 1310 metres amsl. The wreckage had fallen almost vertically through the trees and landed on the bent up bottom skin of the broken right wing. The ground impact had caused the fuselage to break away and to roll on to the left wing. This wreckage had shattered on impact and numerous pieces were strewn around the site. The main wreckage heading was approximately 240° (M).

The main plane/fuselage attachments (bottle pins) were all located and were in the following condition: —

The left forward bottle pin was in position but the structure had broken away.

The right forward bottle pin was in a piece of the fuselage frame (600k) in the nose wreckage area.

The left rear bottle pin was adrift but close to its location in the main wreckage.

The right rear bottle pin was still in position.

The main landing gears were complete, and retracted but extensively damaged by impact. Nos. 2 and 3 rear tyres were still inflated.

The flap screw jacks attached to the wing indicated that the flaps were retracted. Some of the screw jacks had broken away and had extended two or three turns.

The four engines were missing.

All fuel tanks had ruptured and there was a strong smell of kerosene in the area but no evidence of fire.

There was no cabin furnishing in position. It had apparently stripped out due to sudden depressurisation when the forward part of the fuselage broke away. All passenger seats were detached, some had broken away, together with pieces of seat rail, but the majority of seats had broken up.

(It was verbally reported by the police that when they arrived at the scene some passengers were still in their seats with their seat belts fastened).

FORWARD FUSELAGE

The forward part of the fuselage (stn 600k to and including the radome) was about 350 m south west of the main wreckage at an elevation of 1340 m. It was extensively burnt; only the doppler bay and radome had escaped the fire.

This section of the fuselage had also fallen vertically through the trees, almost level fore and aft, and had landed on its right side.

The trees surrounding the wreckage were blackened by fire: a lot of volcanic ash had been shovelled into the fuselage by rescue personnel to extinguish the fire.

A SFIM flight recorder had been installed in the lower nose compartment (lower 41) and after an extensive search burnt and damaged pieces of this recorder were recovered on 16 March '66.

No information was obtained from these pieces.

An RAE (uto observer) camera was recovered and sent to London for examination by RAE. No information was obtained from this instrument

The flight deck clock was recovered: it had stopped and indicated 05 hrs 16 mins.

The nose gear was retracted but wheels and tyres had burnt away: only the wheel bearings and tyre bead wires remained.

RIGHT WING

The outer section of the right wing, complete with outer aileron, had broken off at stn 733. Another piece of wing from stn 733 to about stn 586 but without the bottom skin, had also broken away. This latter piece of wreckage included over half of the outer flap, the outer spoiler and about half of the adjacent spoiler.

The two pieces of wing fell separately about 1¼ km apart and 2 km before the main wreckage but more or less in line across the wreckage trail (positions B1 and B14 refer).

The inner of the two pieces included No. 4 engine position but the engine had broken away and was about 3¼ km further along the wreckage trail, ahead of the main wreckage.

In addition to the two main pieces of wing, pieces of top surface interspar plating had broken away from as far inboard as No. 3 engine.

The evidence of damage to the right wing, of compression buckling on the top skin at the fractures and "tip up" bending or wrinkling of the rear spar in the region of the rear outer spoiler, indicated that the right wing had been subjected to sudden and severe upward loading and this had caused the failures.

(No such buckling was observed on the spar webs of the left wing, although these had mostly broken up upon impact with the ground).

There was no evidence that any part of the starboard wing had struck any part of the aircraft but No. 3 engine

had struck the wing leading edge just inboard of its position.

There was no evidence of pre-accident damage on the wing, all fractures were considered to be of the overload type.

EMPENNAGE—GENERAL

This broke into the following main pieces:—

(a) Right horizontal stabiliser complete with elevator and stabiliser centre section with piece of screw jack and screw jack nut and left horizontal stabiliser rear attachments (Item B5 on the wreckage trail).

(b) Outer piece of left horizontal stabiliser (Item B10 on the wreckage trail).

(c) Left stabiliser front spar inner end with piece of inner rib (Item B9 on the wreckage trail).

(d) Part of left horizontal stabiliser rear spar (Item 4B on the wreckage trail).

(e) Inner piece of left horizontal stabiliser, aft of rear spar, with piece of elevator (Item B3 on the wreckage trail).

(f) Rear part of fin with upper two thirds of rudder (Item B6 on the wreckage trail).

(NOTE: With this piece of wreckage was found a section of fuel feed pipe and a piece of fuel vent ducting from the starboard wing).

(g) Lower part of rudder—location not determined.

(h) Pieces of fin forward of rear spar, pieces of fin leading edge, top of fin (Items A2, B12, B10 on the wreckage trail).

(i) Fin left forward scarf joint (item A41 on the wreckage trail).

Numerous smaller pieces of empennage were scattered along the wreckage trail. These are indicated in the wreckage trail index.

LEFT HORIZONTAL STABILISER

This had broken into numerous pieces and it was evident from blue paint smears on both upper and lower surfaces and on pieces of leading edge that the fin had struck this stabiliser on the upper surface and had then passed underneath it. The marks on the underside extended inboard almost to the root.

The blue paint marks on the underside surface of the outer piece of stabiliser were spanwise at both front and rear.

The front spar attachment fitting had fractured through the top bolt hole and had pulled away the bottom lug on the centre section. The bottom bolt was still in position.

The rear spar had broken just outboard of the attachment to the centre section.

On the inner and outer main pieces there was evidence of tip down bending. On the outer piece there was a tensile type failure across the top skin and evidence of bending across the bottom skin.

At the root attachments there was evidence of tip down bending on the front lower fitting and at the rear there was rearward bending of the centre member. There was also evidence of rearward turning of the rear spar in the twist of the potting compound covering the root attachment pin.

Damage and an imprint on the top surface of the outer piece of stabiliser was made by a piece of left elevator tab.

RIGHT HORIZONTAL STABILISER, CENTRE SECTION AND RIGHT ELEVATOR (Item 85 on the wreckage trail).

This part of the empennage, complete with the stabiliser rear hinges, broke away from the aircraft in one piece, the centre section breaking away on ground impact. The centre section had shattered on impact and the front and rear spars of the right stabiliser had also fractured with impact.

The attachment bolts for the right stabiliser/centre section and the left stabiliser rear spar/centre section were still in position.

The stabiliser rear hinges, mounted at the rear of the centre section had some fuselage plating attached, the condition of which indicated the right stabiliser and centre section had broken away from the aircraft to the right. The hinge attachments to the fuselage were intact, the fuselage plating having failed and released the complete assembly. The jack screw ball nut assembly and the upper part of the jack screw were attached to the centre section. The fracture of the jack screw also indicated that the right stabiliser and centre section had broken away to the right.

The position of the ball nut assembly (4½" from top of jack screw) showed that at the time of the separation there were 1¾ divisions of 'aircraft nose down' trim applied.

FIN

The fin had broken away due to fracture of the front spar members just above the fin/fuselage front attachment pins and fracture of the terminal fittings on bulkhead 1505, just below the fin/fuselage rear attachment pins. The fin had broken into numerous pieces: the largest piece consisted of the rear spar and structure aft of the spar. The piece of fin with the upper two thirds of the rudder hit the ground on the broken fin/fuselage rear fittings and then

fell on to its left side. The lower piece of rudder had broken away in the air.

Examination of the fin/fuselage attachments indicated that the sequence of failure was: —

Firstly—right rear—in tension. This fracture revealed small area of fatigue in bolt hole R1, referred to in the Preface.

Secondly—left forward—in compression, right forward—in tension.

Lastly—left rear—in torsion, with the leading edge of the fin going to the left.

The fin/fuselage front terminal pins were removed and both showed evidence of heavy shear loading, the front right pin under tension and the front left pin under compression (see photographs).

Hardness checks carried out on these steel pins produced the following results: —

Rockwell 'C' scale		
Left terminal pin head	—33:34	(156/159,000 psi)
Left terminal pin shank (with hard chrome removed)	— 40	(186,000 psi)
Right terminal pin head	—38:40	(160/180,000 psi)
Right terminal pin shank (with hard chrome removed)	—39:40	(181,600 psi)

RUDDER

This had broken into two main pieces: one piece, the upper two thirds approximately, remained with the fin: the lower third broke away in the air and fell separately.

As reported under FIN the upper two thirds of the rudder, together with the rear of the fin, fell on to their left side.

At Chofu it was observed that the rudder PCU output rod had fractured under loading from the right. There was a tensil-type fracture on the right side of the rod and evidence of compression on the left side of the rod.

At the time of the PCU rod failure the fractured end of the rod had burred over the end of the piston rod and this prevented the PCU moving in a 'rudder to left' direction.

After failure of the PCU rod the rudder overrode to the left and this occurred before the break-up of the rudder because both pieces showed evidence of override to the left.

The rudder tab damper unit piston rod was bent and the damper unit casing fouled the PCU body which prevented it from moving in a 'rudder to right' direction.

When the above observations were made at Chofu there was 1.5625″ PCU piston rod exposed. Total movement of the PCU is 4.00″ and 1.5625″ represents approximately 5¾° of left rudder.

(Actual measurements on a PCU drawn from Stores were:

Neutral position—bearing centres 20.642″

1.5625″ piston extension—bearing centres 20.242″).

HORIZONTAL STABILISER OPERATING ASSEMBLY

The stabiliser forward cable drum was recovered from underneath the flight deck floor; it had jammed at impact. The broken cable ends came out of the eighth and ninth grooves from the top of the cable drum.

The lower part of the stabiliser jack screw and its operating mechanism were found in the main wreckage. The

screw was broken 21″ from the top of the housing and it was bent. The main electric motor had broken off on impact with the ground but the auto pilot motor was still attached. The operating cables had broken, both cables having run to the bottom of the drum.

Checks on Boeing 707 G-APFK showed the following:—

With the cables on the forward drum coming out of the eighth and ninth grooves from the top of the drum the stabiliser position indicator was at zero. In this position there was approximately 7″ of jack screw above the nut. With the cables on the rear drum at approximately 2½ turns from the bottom of the drum the stabiliser position indicator was at the maximum 'aircraft nose down' position. The position of the cables on the rear drum of FE, therefore, indicate a position beyond the normal maximum 'aircraft nose down' trim position.

The cables run through the floor beams approximately 9″ each side of the aircraft centre line. With a broken right side cable (e.g. at stn 600k), pull on the left side cable will run the rear drum in the 'aircraft nose down' direction and the forward drum in an 'aircraft nose up' direction.

NOTE:

Assuming in the case of FE the right side cable did break first, as the forward fuselage broke away to the left, then the following observations would apply:—

Prior to breakaway of the forward fuselage the rear drum could only have been 1¾ divisions 'aircraft nose down' or less than this because a pull on the left cable would bring the cable down the drum and run the

jack screw nut upwards (towards 'aircraft nose down'). By the same assumption the forward drum could only have been in neutral position or further in the 'aircraft nose down' direction because a pull on the left cable would move the cables down the drum (towards 'aircraft nose up').

ENGINES

Nos. 1, 2 and 4 engines were found about 1 km ahead of the main wreckage and No. 3 engine nearly 2 kms ahead of the main wreckage.

There was no evidence of fire and the condition of the rotating assemblies indicated that these had almost stopped at the time of impact with the ground. There had been no in-flight break-up of the turbines or compressors.

The fractures of the engine mountings indicated that the engines had all broken away to the left and downwards.

No. 3 engine had lost its side cowling and there was evidence that this engine had struck the wing leading edge just inboard of its position. Pieces of No. 3 engine cowling were found along the wreckage trail.

The engine mounting fractures were as follows:—

Engine Number	Failure of top strut at:	Failure of bottom tubular strut at:
1	Mounting	Rear lug
2	Mounting	Forward lug
3	Forward fitting	Forward lug
4	Mounting	Forward lug at bolt holes

On No. 1 engine mounting support there was a small area of fatigue. The location of the fatigue was at the inner radius of the outer flange adjacent to the head of bolt, item No. 13 (Parts Catalogue 57-03-16, page 1, item 17 refers). The Parts Catalogue defines this part of the structure as "support, outboard nacelle inboard forward drag left hand".

The crack measured 5/16" long x ⅛" deep with a crack growth line measuring 1¼" long x ½" deep. This defect was not considered relevant to the accident.

HP Cocks

Engine No. 1	Indicator beyond SHUT. Control rod broken.
Engine No. 2	Not found.
Engine No. 3	Indicator at about SHUT. Control rod adrift.
Engine No. 4	Indicator at about SHUT. Control rod adrift.

It was apparent that the cock positions, as first seen at Chofu, were not reliable evidence of their flight positions.

Control Surfaces

Flaps	All fully retracted
Ailerons	Outer left and right—at lock-out position (Right inner aileron—override upwards. Not considered relevant
Rudder	Had overridden to left after failure of PCU output rod

	and before rudder broke into two main pieces
Elevators	No override
Horizontal Stabiliser	At 1¾ divisions 'aircraft nose down' at time of breakaway from aircraft
Exits	All (including overwing emergency exits) located with the exception of the left forward passenger door. The forward fuselage lay on its right side and was extensively burnt

Cylinder/Bottles

The following is a list of cylinders and bottles which were found during the field examination. Most of these containers were empty and none had exploded.

Main wreckage area	4 passenger oxygen 2 passenger oxygen (portable) 3 dinghy inflations (one still in dinghy valise) 2 air No. 1 engine fire extinguisher bottle
In forward fuselage	1 crew oxygen 2 air 1 passenger oxygen (portable) 2 dinghy inflation
In addition	2 hand fire extinguishers No. 4 engine fire extinguisher

Boeing Exhibit D-10

At Chofu the main and auxiliarly hydraulic reservoirs were found damaged but intact.

The official report on the accident will be made by the Japanese investigation team.

Boeing's Memorandum in Support of Its Motion for Summary Judgment and in Opposition to Plaintiff's Motion for Partial Summary Judgment

UNITED STATES DISTRICT COURT

WESTERN DISTRICT OF WASHINGTON AT SEATTLE

NOS. C74-257S and C74-380S

BRITISH OVERSEAS AIRWAYS CORP.,

Plaintiffs,

v.

THE BOEING COMPANY,

Defendant.

Boeing was surprised when it learned of plaintiff's motion for summary judgment. Plaintiff's attorneys know that Boeing disagrees with *their* theory as to how the accident occurred. Put simply, Boeing believes that the accident was caused solely because plaintiff's pilot flew the aircraft into the Mt. Fuji mountain wave turbulence—an action by plaintiff which shattered the aircraft in flight just as surely as flying into Mt. Fuji itself. Within seconds the forward fuselage, starboard wing, vertical fin, horizontal stabilizers and all four engines broke away from the remainder of the aircraft.

After receiving BOAC's motion for summary judgment Boeing took the depositions of present and former BOAC employees in London. At these depositions Boeing learned from BOAC documents produced to its counsel there for

the first time that BOAC's position during the ten years since the accident has been consistent with Boeing's and totally at odds with the notion that BOAC has a claim against Boeing for the loss of the aircraft. The minutes of the BOAC Air Safety Committee of July 20, 1967 state:

> "INCIDENT/ACCIDENT REPORT No. 558
>
> ".11RR707/615 Flight/aircraft broke up in flight.
>
> "The Committee thanked Chief Inspector of Accidents for this very clear and concise report on this accident. It was noted that the cause of the accident was abnormally severe CAT which imposed excessive loads on the aircraft—beyond its design limits. Action taken over the years to inform all staff of the problems of turbulence was noted." (Boeing Exh. No. D-2.)

This conclusion was reached after sixteen months of intensive investigation by BOAC using "all possible professional help." (Minutes of BOAC Air Safety Committee for April 20, 1966, Boeing Exh. No. D-3.)[1]

[1] Because these newly discovered BOAC documents (particularly the BOAC Air Safety Reviews and the minutes of the BOAC Air Safety Committee, Boeing Exhibits D-1, D-2, D-3, D-4 and D-7) are strong evidence against BOAC, Boeing made the cross-motion for summary judgment filed with this memorandum. Because of the deadline (August 16) for filing Boeing's opposition papers to BOAC's earlier motion, the fact that the matter is now scheduled for trial in November, and the desire to preserve whatever economy can be had from hearing both summary judgment motions together, Boeing is filing its cross-motion at this time even though transcripts of the depositions of present and former BOAC employees conducted in London from July 19 through 30, 1976 are not yet available. Therefore, in its motion, Boeing is requesting leave to supplement its moving papers with relevant extracts from these transcripts, particularly so that Boeing's counsel may properly authenticate the official BOAC report of this accident and other admissions contained in the BOAC Air Safety Reviews.

Almost immediately after the subject crash BOAC, the Japanese government and the British government (through its Royal Aircraft Establishment and Ministry of Aviation) launched investigations to determine the cause of the accident. Boeing, which did not conduct a separate investigation of its own, rendered assistance to both the Japanese and British governments and to BOAC. The evidence of what happened was sufficiently clear that in the end all government agencies, as well as Boeing and BOAC, reached the same conclusion: the aircraft broke up in flight due to severe turbulence in excess of the design strength of the aircraft.[2]

[2] The Japanese report (Pltf's Exhibit No. 8, p. 25) concluded that:

> "The probable cause of the accident is that the aircraft suddenly encountered abnormally severe turbulence over Gotemba city which imposed a gust load considerably in excess of the design limit."

This portion of the Japanese report was adopted verbatim by BOAC in its official report (BOAC Incident/Accident Report No. 588, Boeing Exh. No. D-1), p. 2). Furthermore, Boeing has always agreed with this conclusion.

Finally, F. H. Jones of the British Royal Aircraft Establishment concluded that:

> ". . . the aircraft disintegrated whilst flying at an altitude of about 5000 meters when it was about 7 kilometers to the southeast of Mt. Fuji.
>
> "The aircraft failed under sideload and there was no indication that the failures had been associated with any pre-crash weakness or malfunction." (Royal Aircraft Establishment Technical Report No. 66322, Boeing Exh. No. D-6, p. 1.)

Boeing's Memorandum in Support of Its Motion for Summary Judgment and in Opposition to Plaintiff's Motion for Partial Summary Judgment

STATEMENT OF FACTS

A. *The Physical Evidence.*

Examination of the wreckage showed that the aircraft disintegrated in mid-air. The findings of the investigators were that the following failures occurred in the air:

(1) the right wing experienced severe and sudden upward loading and failed upwards both outboard and inboard of the (far right) No. 4 engine;

(2) the forward fuselage broke away to the left of the aircraft and downward;

(3) all four engines failed to the left of the aircraft and downward;

(4) the vertical fin failed to the left and struck the left horizontal stabilizer; and

(5) the left horizontal stabilizer failed as well as the remainder of the empennage.

There was a small fatigue crack in one of the vertical fin attachment fittings. A Boeing metallurgist discovered that crack while examining the aircraft wreckage, and Boeing notified the investigating authorities and all 707 operators. Thorough accident investigations often reveal information about aircraft which will be of interest or concern to operators. This is the case whether or not the information has anything to do with the *cause* of the accident being investigated.

Boeing has always believed that the fatigue crack in the fitting was irrelevant to the cause of the accident. BOAC

Boeing's Memorandum in Support of Its Motion for Summary Judgment and in Opposition to Plaintiff's Motion for Partial Summary Judgment

(as distinguished from BOAC's attorneys) does not appear to disagree. In its official report of the accident BOAC states that:

> "The fin fitting was released to Boeing for detailed metallurgical examination and they concluded that these cracks were not an accident cause factor" (Boeing Exh. D-1, p. 5)

without suggesting in any way that it disagreed with Boeing's conclusions. Furthermore, as stated in the affidavit of John D. Dillow, Esq. (Boeing Exh. No. D-9), the transcripts of the BOAC deposition, when available, will show that neither John R. Boulding, who was at the time of the report BOAC's Chief Inspector of Accidents, nor Captain Nisbet, presently Chairman of the BOAC Air Safety Committee, and BOAC's General Manager of Flight Operations at the time of the crash, disagreed with that statement, knew of any others who disagreed with the statement, or knew of any documents which contradicted the statement.

B. *The Meteorological Conditions.*

As noted at the outset of this memorandum there was extreme turbulence in the form of a "mountain wave" the leeward (southeastern) side of Mt. Fuji on the day of the accident. This conclusion was reached by BOAC, Boeing and everyone else involved in the accident investigation.

The official BOAC report contains an extensive discussion of the weather conditions at Fuji on the day of the accident.

"A strong mountain wave situation existed over Honshu on 5 March 1966. Wave clouds were detected by satellite ¾ hour before accident time to west and southwest of Fuji; the lack of wave clouds over Central Honshu is attributed to very dry air following the passage of the WNW airstream over the Japanese Alps. The wavelength of lee waves is estimated at around 13 miles and there is considerable support for a case of wave resonance to the lee of Fujisan with the possibility of a rotor, in the vicinity of Gotemba where the accident is thought to have occurred. The precise effects of a conical mountain, such as Fujisan, on a system of waves set off by the Japanese Alps are not known but theory suggests that a first leewave of considerable amplitude could have existed." (Boeing Exh. No. D-1, pp. 8-9.)

Subsequently *BOAC published in its July 1968 Air Safety Review* a reprint of the report of a former U.S. Navy pilot (and a pilot for United Air Lines at the time of the report). The report, a copy of which is appended to Boeing's cross-motion as Exhibit D-4, says in part:

"An Encounter With Extreme CAT [Clear Air Turbulence]"

"In March 1966, a BOAC 707 was destroyed in the air by an extreme mountain wave generated by Mt. Fuji outside of Tokyo. The following excerpt from a personal account of an experience with the same turbulence pattern by one of United Air Lines' new pilots should be of interest to all flight officers as a reminder

of how violent mountain waves can be under the right set of conditions.

"'. . . As I neared the crash site, I descended from 11,000 ft. MSL to 5000 ft. AGL and immediately—like running into a brick wall—was tossed about so violently that I was unable to read any instruments and had my hands completely full trying to keep my airplane upright. One fitting of my oxygen mask was shaken loose and as my head was banging back and forth off the canopy, the brilliant thought entered my mind that I should get the h - - - outta there. Somehow I managed to keep the nose pointed more up than down and eventually climbed to 16,000 ft. MSL, all the time being batted around by the turbulence in the lee of Mount Fuji. From the comparative calm of that altitude, I directed the rescue helicopter toward the crash but the turbulence was too great even for him to get within 5 miles of the scene.'"

Finally, a study of clear air turbulence in the vicinity of Fuji was conducted by Dr. Seiji Sohma, chief of the First Research Division of the Physiometeorological Research Department of the Japanese National Meteorological Institute. A summary of Dr. Sohma's findings *was published by BOAC* in its December, 1970 Air Safety Review. This summary states, in part:

"A mysterious air turbulence has proved to be the cause of the crash of the BOAC Boeing 707 jetliner on March 6, 1966, near Mr. Fuji, in which 124 crew members and passengers perished. . . .

"Dr. Sohma, as a result, has recently found that the clear air turbulence could be caused by a peculiar air flow, which he has called 'peel-off' near the summit of Mt. Fuji. The 53 year old researcher says that the 'peel-off' turbulence is more severe than air turbulence within cumulonimbus which aircraft have been told never to enter. It is only natural he says, that the BOAC jetliner was instantly destroyed when it flew into the 'peel-off' turbulence.

* * *

"In winter, strong westerly winds blow against the slope of Mt. Fuji and pass over the mountain after hitting the top. At this moment, a strong air flow develops on the lee side of the mountain and blows up along the slope toward the summit ('peel-off' phenomenon). This strong air current blowing upwards causes numerous vortices to develop east of the mountain top. This clear air turbulence is peculiar to the 3776 metre high peak.

"Dr. Sohma has devoted the past three years to confirming this phenomenon through various observation experiments. For example, a parachute with flashbulbs was dropped from a plane at dusk on the west side of Mt. Fuji and observations were made on how the parachute drifted. Another test involved the photographing of flying balloons with a 16mm camera.

"Through such tests the real character of the air turbulence around the solitary mountain of Fuji has come to light. The turbulence arises in an area 1 km wide and 15-20 km long, east of the mountain summit, when strong westerly winds of more than 25 metres

per second blow (about 50 knots). And the turbulence is the severest ever observed by meteorologists.

"Winds of about 35 metres per second are said to have been raging near the top of Mt. Fuji when the BOAC jetliner crashed around 2:15 pm on March 5, 1966. It can be theorized, therefore, that the plane disintegrated instantaneously as it was engulfed into the air turbulence caused by the 'peel-off' phenomenon near the summit." (Boeing Exh. D-7.)

C. *Boeing's Theory of the Accident.*

Boeing's position has always been that the accident was caused by the actions of the BOAC pilot in flying the subject aircraft so close to the lee of Mt. Fuji that the aircraft encountered severe turbulence—in the form of "mountain waves"—well in excess of the design strength of the aircraft and, as a result of such turbulence, broke up in flight.[3] As already noted Boeing agrees that prior to the accident there was a small fatigue crack in the right hand vertical fin attachment fitting and that when the fitting failed during the break-up sequence it failed along this fatigue crack. Boeing does not agree, however, that it was responsible for the crack,[4] that the crack caused the fitting to fail, or that

[3] See Boeing Answers to Interrogatories No. 24, 30, 32, 36, 38, 42, and 139 through 144.

[4] Boeing does not base its own motion for summary judgment on this point; however, it does assert in connection with BOAC's motion for summary judgment that BOAC, which has the burden of proof on this point, has not introduced any evidence that the crack had its genesis in the manufacturing process. *See* Appendix A to this memorandum. It may become established during further discovery that the crack arose after the aircraft was delivered to BOAC.

the crack and the fitting failure played any role in causing the subject crash.

As set forth in the affidavit of Howard W. Smith, an expert in structures (Boeing Exh. No. D-8), the only logical explanation for the various in-flight failures which occurred (outboard starboard wing, vertical fin, horizontal stabilizers, engines, forward fuselage) is that the break-up of the aircraft was almost instantaneous, and that the aircraft failed because it encountered gust loads in excess of what it was designed to withstand.

D. *BOAC's Theory of the Accident.*

BOAC appears to agree in all significant respects with Boeing's assessment of the cause of the accident. BOAC's official report of the accident (Accident/Incident Report No. 558), reached after sixteen (16) months of intensive investigation, marked "closed" and never reopened, concludes that:

> "The evidence provided by the aircraft wreckage, the injuries to the victims and the evidence from the colour film suggests that the aircraft suddenly encountered abnormally severe gust loads exceeding the design limit load over Gotemba City and disintegrated in the air in a very short period of time." (Boeing Exh. D-1, pp. 1-2.)

and that:

> "The probable cause of the accident is that the aircraft suddenly encountered abnormally severe turbulence over Gotemba City which imposed a gust load considerably in excess of the design limit." (Boeing Exh. D-1, p. 2.)

To understand just how deeply committed BOAC is to the theory that abnormally severe clear air turbulence was the cause of the subject accident, this Court should review BOAC's official report. The report, which covers some nine pages, contains *no suggestion whatever* of any responsibility on Boeing's part for the accident. It does, however, contain the detailed statement of meteorology quoted above. Furthermore, later issues of BOAC's Air Safety review also refer to the abnormal turbulence at Fuji that day.

BOAC's belief in the accuracy of the conclusions of its official report is further evidenced by the fact that on July 26, 1976 BOAC submitted to the International Air Transport Association (IATA) Incident and Accident Information Exchange Group for dissemination to member airlines a virtually identical report (Boeing Exh. No. D-5) on the accident.

Finally, the depositions recently conducted in London by Boeing counsel establish that BOAC still accepts the Japanese report and believes that the accident was caused by clear air turbulence in excess of what the aircraft was designed to withstand. Ben J. Folliard, who was Chief Inspector of Accidents for BOAC at the time of the subject crash and whom counsel for BOAC designated as "the officer, director or employee of BOAC, or the former officer, director or employee of BOAC most knowledgeable with regard to the cause of the crash of the Boeing 707 aircraft, registration G-APFE, on or about March 5, 1966" (pur-

suant to the notice of deposition filed by Boeing on BOAC on June 1, 1976) testified that BOAC "accepted" the conclusion as to the probable cause of the G-APFE accident reached by the Japanese in its official report.

ARGUMENT

I. *Boeing Is Entitled to Summary Judgment.*

Despite the fact that in ten years it has never suggested any connection existed between the cracked fin attachment fitting and the crash, BOAC must, in order to win this lawsuit, prove that just such a causal connection did exist after all. BOAC has no other way to go. No other failure can *possibly* be attributed to a product defect. Examination of the fracture surfaces of the other failed parts revealed that all of the fractures were of an overload type and that except for the vertical fin attachment fitting there was no evidence of fatigue cracking or other structural imperfection in any of the failed parts. BOAC has accepted and adopted these conclusions.

Boeing does not know why BOAC's insurers now disagree with their insured as to the cause of the accident. It does know, however, that because there is no possibility BOAC can prove that the accident was caused by the failure of the vertical fin attachment fitting, Boeing is entitled to summary judgment.

In considering Boeing's motion for summary judgment it is important for this Court to know just what Boeing's burden of proof on the motion is. It is well settled that Boeing, as moving party, has the burden of proof on its motion even though BOAC will have this burden at trial.

See Doff v. *Brunswick Corp.*, 372 F.2d 801, 805 (9th Cir. 1966), *cert. denied*, 389 U.S. 820 (1967).[5] But this does not mean that Boeing must prove that the crack did not cause the fin to fail or that the fin failure did not cause the crash; rather it means only that Boeing must prove beyond doubt that BOAC, the plaintiff, cannot meet its burden of proof at trial. This point is demonstrated by the case of *Van Dyke* v. *Merchants Indemnity Co.*, 215 F. Supp. 428 (E.D. Wis. 1963).

Van Dyke was an automobile accident case in which the plaintiff passenger sued the deceased driver's liability insurance carrier. The evidence showed that the defendant's vehicle left its lane of traffic and struck a utility pole. An autopsy of the driver showed that he died of heart attack. The plaintiff had no recollection of the accident and there were no other witnesses. There was conflicting medical opinion testimony as to whether the collision might have precipated the heart attack. Ignoring this conflict the court granted summary judgment for the defendant, stating:

> "The circumstances as found following the accident reveal a possible nonactionable explanation thereof. The jury may not speculate between this event and an

[5] Burden of proof is substantive for *Eire* purposes. *Cities Service Oil Co.* v. *Dunlap*, 308 U.S. 208 (1939). In an action transferred pursuant to 28 U.S.C. § 1404(a) this court must apply the law of the transferor forum, *Van Dusen* v. *Barrack*, 376 U.S. 612 (1964), in this case either New York or California. Under either law the burden at trial will be in BOAC to prove that the alleged defect *was* a proximate cause of the injury. *Williams* v. *State*, 306 N.Y. 548, 127 N.E.2d 545 (1955); *Grinnell* v. *Pfizer*, 274 Cal. App. 2d 424, 79 Cal. Rptr. 369 (1969); *see also Restatement (Second)* of Torts § 433B(1); 432, comment *c*.

inference of negligence based on application of the doctrine of *res ipsa* to determine causation and liability in this action. Plaintiff has not shown the availability of further affirmative proof of the driver's negligence to raise an issue of triable fact. Plaintiff's case must fail because she cannot meet the required burden of proof.

"For the foregoing reasons, defendant's motion for summary judgment must be and it is hereby granted." 215 F. Supp. at 430.

To the same effect is *Dyer* v. *McDougall,* 201 F.2d 265 (2d Cir. 1952) (opinion by L. Hand).

Applying the principles of these cases to the present action Boeing is entitled to summary judgment if it now appears that plaintiff cannot prove by a preponderance of the evidence at trial that the fatigue crack in the fin caused the aircraft to crash.

The evidence of how the accident occurred is totally inconsistent with plaintiff's assertion of a causal connection between the fatigue crack in the vertical fin fitting and the crash of the aircraft. Rather, the evidence points to the conclusion accepted by all who were involved in the investigation of the accident—including BOAC—that the break-up of the aircraft was virtually instantaneous and that break-up would have occurred whether the one vertical fin fitting had been cracked or not. Acceptance of these conclusions requires a finding that there was no proximate cause between the alleged defect and the crash.

As noted, it is not Boeing's burden on this motion to prove that the alleged "defect" in the vertical fin attach

fitting did not proximately cause the accident. Boeing need only prove that BOAC, the plaintiff, cannot possibly meet its burden of proof as to causation which it will hear at trial. Boeing has done this and is entitled to summary judgment.

II. *Alternatively, BOAC Is Not Entitled to Partial Summary Judgment.*

It should be apparent that BOAC is certainly not entitled to summary judgment. Boeing's theory of the accident supports the conclusion the cracked fin fitting did not proximately cause the accident. Furthermore, Boeing's theory also supports the conclusion that the aircraft was not at the time of the accident (and, *a fortiori,* at the time of sale) in a defective condition.[6]

A product is "defective" only if it is not "safe for *normal* handling and consumption" *Restatement (Second) of Torts* § 402A, comment *h* (emphasis supplied). Boeing's evidence and theory of the case are that the vertical fin attach fitting (the only portion of the aircraft which plaintiff even suggests was defective) failed only when subjected to extremely *abnormal* conditions. There is no evidence that the fitting would have failed under normal con-

[6] In making its motion for summary judgment, the plaintiff has placed its sole reliance upon the Washington law of strict products liability, as announced in *Ulmer* v. *Ford Motor Co.,* 75 Wn.2d 522, 452 P.2d 729 (1969), and its progeny. Boeing does not concede the applicability to the facts of this lawsuit of Washington law or the doctrine of strict liability in tort under any applicable law. Nevertheless, even assuming for the moment that plaintiff is correct in its assertion that the Washington law of strict liability in tort governs this lawsuit, it is apparent that there is no basis for summary judgment in BOAC's favor.

ditions and, therefore, no evidence that it was "defective."

Secondly, under the *Restatement* a product is "unreasonably dangerous" only if it is dangerous "to an extent beyond that which would be contemplated by the ordinary consumer who purchases it, with ordinary community knowledge as to its characteristics." *Restatement (Second) of Torts* § 402A, comment *i*. This standard, with its emphasis upon the expectations of the ordinary purchasers, has been adopted in Washington in design defect cases. *Seattle-First Nat'l Bank* v. *Talbert*, 86 Wn.2d 145, 154, 542 P.2d 774 (1975). If Boeing's theory that the fin failure occurred only when the aircraft was subjected to gusts in excess of the design strength of the aircraft were accepted, the trier of fact could infer that the fin fitting was *not* dangerous beyond the expectations of ordinary purchasers of 707 aircraft.[7]

Boeing feels that it is entitled to summary judgment because BOAC cannot prove that any defect in the aircraft *caused* the subject crash. Because this case can be decided in Boeing's favor on this single issue of causation Boeing does not feel it is necessary to ask this Court to spend its time reviewing each and every shortcoming in the case presented by BOAC. Boeing is, however, greatly troubled by plaintiff's "cut and paste" presentation and somewhat concerned that the Court not develop a misimpression as to other aspects of the case.

[7] "On summary judgment the inferences to be drawn from the underlying facts must be viewed in the light most favorable to the party opposing the motion." *United States* v. *Diebold*, 369 U.S. 654, 655 (1962).

Because of this concern we have prepared four Appendices to this memorandum setting forth in some detail Boeing's position that much of what is said in plaintiff's motion and supporting papers is without evidentiary or logical support. Thus,

> * Plaintiff has asserted numerous facts to be "judicial admissions" of Boeing when it knows Boeing's position on these facts to be otherwise; it has also misrepresented the import of other evidence.[8]
>
> * Plaintiff has drawn numerous conclusions of fact with no logical support whatever for such conclusions indeed, in some places plaintiff seems to be asking this Court to draw inferences of fact which can only be done by experts.[9]

Instead, plaintiff has attempted to camouflage these weaknesses in its presentation with a smokescreen of extraneous material[10] and patently inadmissible evidence.[11]

Boeing does not feel that resolution of this motion requires any detailed consideration of the case presented by plaintiff; however, if this Court feels differently, we invite its attention to the Appendices to this memorandum.

[8] *See* Appendix A and Appendix D to this memorandum.

[9] *See* Appendix A to this memorandum.

[10] *See* Appendix C to this memorandum.

[11] *See* Appendix B to this memorandum.

CONCLUSION

For the reasons stated, this Court must grant Boeing's motion for summary judgment and deny plaintiff's motion.

DATED this 16th day of August, 1976.

PERKINS, COIE, STONE,
OLSEN & WILLIAMS
Keith Gerrard
John D. Dillow
Richard C. Coyle

By /s/ RICHARD COYLE
Richard C. Coyle

Attorneys for Defendant
The Boeing Company

APPENDIX A

BOAC'S FAILURE OF PROOF

Plaintiff's position is disarmingly simple: the vertical fin was the major piece of wreckage found furthest away from the main wreckage; therefore, it was the first structural component of the aircraft to fail. Because the fin was the first to fail it must have caused the crash. The failure occurred along a pre-existing fatigue crack. Because the fitting wasn't designed to crack, it must have been "defective" at the time of sale. Because the "defective" fitting caused the accident it must have been unreasonably dangerous.

In addition to its principal point that the crack in the fin fitting could not have caused the crash—and that BOAC has admitted as much—Boeing submits that plaintiff has utterly failed to meet its burden of proof on a number of other critical items:

A. *BOAC Has Failed to Prove That the Vertical Fin Was the First Structural Component to Fail.*

Plaintiff uses four pieces of evidence in its attempt to establish that the vertical fin failed first. The *first* is the existence of such a statement in the Japanese report[1] combined with the testimony of a Boeing employee, Howard W. Smith, that "[w]e found nothing of substance in [the Japanese report] to disagree with that I'm aware of" (Plaintiff's Memo, pp. 10-12). This statement by Smith cannot reasonably be construed as adoption of the entire

[1] The Japanese report itself is clearly hearsay.

Japanese report—and, particularly, not an adoption of a statement in the report which, in virtually the same breath, he contradicts.[2]

---

[2] *On the same page* of his deposition Smith testified:

"Q. Was any report made on the in-flight breakup sequence?

"A. Not to my knowledge.

"Q. Did you form any opinions on that subject?

"A. Very definitely.

"Q. What opinion did you form?

"A. Well, *I formed the opinion that the only logical breakup sequence was one in which the wing failure,* upward bending of the right-hand outer panel, *occurred substantially simultaneously with the downward bending failure of the forward body* just ahead of the front spar; *and that perhaps in a matter of additional seconds the fin failed* as a result of the aerodynamic instability of the airplane that remained after the wing and body were gone, wing segment and body segment were gone." (Deposition of Howard W. Smith, Pltf's Exh. No. 9, p. 6, *l.* 15 through p. 7, *l.* 4) (Emphasis supplied.)

Smith's statement concerning the Japanese report is undoubtedly accurate viewing the report as a whole. As already noted, the final conclusions of the Japanese report are totally consistent with Boeing's position. Indeed, while the report contains in a section on "Tests and Research" the trajectory data quoted in plaintiff's brief, in the "Analysis and Conclusions" section elsewhere in the same report appears the statement that "it was not possible to establish the breakup sequence" (Japanese Report, Pltf's Exh. No. 8, p. 22). *This is the same conclusion reached by B. J. Folliard, BOAC's Chief Inspector of Accidents.* See Preliminary Accident Investigation Report, Section 3 Technical Report, Boeing Exh. No. D-10, p. 4:

"No physical evidence was found to determine the sequence of the break-up of the aircraft and the wreckage trail gave no positive indication."

Moreover, BOAC's own official report of the accident which quotes extensively from the Japanese report does *not* adopt the statement in the Japanese report dealing with sequence of failure.

Yet another version of the sequence of failure is ascribed to by

The *second* way plaintiff attempts to prove that the fin failed first is from the wreckage distribution chart (Pltf's Exh. No. 10) which, according to plaintiff, shows the vertical fin as the major piece of structure furthest away to the north from the main wreckage (Plaintiff's Memo, p. 12).[3] According to plaintiff's counsel, that "establish[es] that [the fin] separated first from the aircraft." Boeing's counsel fails to see how Your Honor (or any layman) can draw such a conclusion from the single allegation that the fin was furthest from the main wreckage.

Thirdly, the plaintiff relies upon a photograph (Pltf's Exh. No. 14) which in plaintiff's counsel's opinion depicts the G-APFE during descent (although the photograph is not identified by anyone) and which plaintiff's counsel describes as "graphic evidence" that the fin failed first.

F. H. Jones who investigated the Fuji crash on behalf of the British Royal Aircraft Establishment:

"Local sequence established that the rudder power control unit output rod failed before any other component in the tail unit, and that the lower third of the rudder was the first item to become detached from the tail. These features preceded failures of the fin, horizontal stabilizer and the forward fuselage.

"It was also established that all four engines became detached in a common manner, and there were strong indications that this had occurred before failure and detachment of the outer starboard main-plane.

"No overall sequence of failure for the whole aircraft could be determined. A study of the wreckage distribution, and of the trajectories of the falling pieces, did in fact suggest that much of the disintegration was virtually instantaneous, with no particular component markedly in advance of the others in the sequence of failure." (Boeing Exh. D-6, p. 1.)

[3] The inadmissibility of this document is discussed in Appendix B, pp. ..... .

Boeing's counsel doesn't know what can be learned from expert analysis of that photograph. It does know, however, that to the naked eye the photograph does *not* "clearly show the wings still attached to the aircraft" and the vertical fin "conspicuously missing."

Finally, "as further corroborative . . . testimony from Boeing showing that the vertical fin . . . first separated," plaintiff points to certain statements by witnesses Morgan and Hansen in their depositions (Plaintiff's Memo, pp. 14-15). In essence, witness Hansen testified in response to a question by counsel for one of the passengers that, although the subject was out of his field, he had heard of Boeing planes which had lost a section of the starboard wing and landed. Witness Morgan testified that a failure of the terminal fitting "can lead to catastrophic failure." These statements prove nothing. The fact that some planes have survived the loss of part of a wing, and others can experience "catastrophic failure" at the loss of the vertical fin does not mean that in this case the fin came off before the wing and caused the crash.

That is the sum of plaintiff's evidence that the fin failed first. Not only has plaintiff not established beyond doubt that the vertical fin failed first, it has not produced *any* admissible evidence which could lead a court or jury to reach that conclusion.

B. *BOAC Has Failed to Prove That a Defect Existed in the Aircraft At the Time of Sale.*

Having satisfied itself that the fin failed first, plaintiff next asserts that Boeing has admitted that the failure was the result of a defect which existed in the fitting at the time of sale. Once again plaintiff misses the mark.

Plaintiff's Point II, consisting of ten pages (16-25), is an effort to persuade the Court that Boeing has admitted that "final fracture of the right fin body terminal fitting [of the aircraft] initiated at a fatigue crack which existed prior to the subject crash at hole R-1 of the fitting" and "that [the same fitting] contained areas of untempered martensite[4] . . . found in the bores of holes R-3 and R-29."

The entire discussion of untempered martensite is a pig-in-a-poke. The evidence is clear that the fitting failed along a fatigue crack originating in hole R-1. There is no mention of untempered martensite in hole R-1.[5] Plaintiff has introduced no evidence of a connection between the fatigue crack in R-1 and the untempered martensite in R-3 and R-29. Indeed, the only evidence is to the contrary. Boeing metallurgist A. C. Larsen testified as follows:

> "Q. Could the fatigue crack in hole R-1 have any relationship at all with the cracks and pockets of cracked untempered martensite which was [*sic*] observed in holes R-3 and R-29?
>
> "A. No." (Deposition of A. C. Larsen, Pltf's Exh. No. 16, v. II, p. 24.)

Thus plaintiff has utterly failed to tie the fatigue crack in the fin to any condition which might have existed[6] in

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[4] Plaintiff nowhere establishes that the existence of untempered martensite is a "defective condition" in the legal sense.

[5] Pltf's Exh. No. 18, a Boeing metallurgical report, affirmatively states that "hole R-1 showed a tempered martensite structure. No positive evidence of untempered martensite was found."

[6] Even if untempered martensite had been relevant to the crack plaintiff still failed to show that it was caused by Boeing. See Appendix D, pp. .....

aircraft G-APFE at the time of its manufacture and sale to BOAC.

C. *BOAC Has Totally Ignored a Number of Vital Links In Its Chain of Circumstantial Evidence.*

What one is left with, viewing plaintiff's evidence as a whole, is that there was a fatigue crack originating at hole R-1 in this fitting prior to the crash. There is no evidence as to how the fatigue crack arose, nor is there any evidence that the fatigue crack by itself indicates a shortcoming in either design or manufacture. There is some evidence of untempered martensite in *other* holes in the fitting, but there is no evidence how this condition arose or that it was at all related to the failure of the vertical fin.

Appendix B

BOAC's Extensive Use of Inadmissible Evidence

Not only has BOAC failed to make out even a prima facie case of strict liability in tort, but much of the case it has presented has been accomplished through the use of patently inadmissible evidence. Boeing need only catalog the examples:

1. *Exhibit No. 8:* The Japanese Civil Aeronautics Board Accident Report. This report has already been discussed in Boeing's memorandum and in Appendix A thereto. Although the report is favorable to Boeing it is, nevertheless, hearsay. Furthermore, plaintiff's apparent attempt to make this report an "adoptive admission" of Boeing under Fed. R. Evid. 801(d)(2)(B) and 801(d)(2)(D) should also

fail. Mr. Smith's testimony that he "found nothing of substance to disagree with" is hardly an unambiguous assent to the accuracy of all statements in the report—particularly the statement in the report most relied on by plaintiff (as to the sequence of failure) which (a) is contradicted elsewhere in the same rfeport and (b) is *specifically rejected* by Mr. Smith on the same page of his deposition.

2. *Exhibit No. 10:* Wreckage Distribution Chart (multiple pages). According to plaintiff this chart shows, *inter alia,* the vertical fin as the major piece of wreckage furthest from the main wreckage. The chart is not authenticated and is hearsay. Plaintiff refers to the chart as being "identified" by witness Hansen (Plaintiff's Memo, p. 12), but a review of the cited section of transcript shows only that Mr. Hansent identified *one page* (Figure 5 attached to the Japanese report) of plaintiff's *multi-page* Exhibit 10 as a document which he "had seen before." Mr. Hansen neither authored the document nor affirmed its accuracy.

3. *Exhibit No. 11:* Photograph of Vertical Fin and Stabilizer. Plaintiff's counsel describes this photograph as showing "the vertical fin located farthest (to the north) from the main wreckage (background of Exhibit 11)" (Plaintiff's Memo, p. 12). The photograph is not identified and there is no evidence from which direction (or, for that matter, of which aircraft) the picture was taken. Furthermore, while the stabilizer can be seen in the picture by the naked eye, the "main wreckage" cannot—and there is no testimony by the photographer (or anyone else) explaining

where in the picture the "main wreckage" is supposed to be.

The photograph is plainly inadmissible because it is not authenticated. Fed. R. Evid. 901(a). Furthermore it certainly does *not* show what plaintiff claims it shows.

4. *Exhibit No. 14:* Photograph of Falling Aircraft. The irrelevancy of this photograph has already been noted in Appendix A. Furthermore, the photograph has not been authenticated.

5. *Exhibit No. 19:* Boeing Service Bulletin 2422. This exhibit is patently inadmissible under the rule prohibiting the use of subsequent remedial measures. Fed. R. Evid. 407 provides:

> "When, after an event, measures are taken which, if taken previously, would have made the event less likely to occur, evidence of the subsequent measures is not admissible to prove negligence or culpable conduct in connection with the event. This rule does not require the exclusion of evidence of subsequent measures when offered for another purpose, such as proving ownership, control, or feasibility of precautionary measures, if controverted, or impeachment."

Apparently recognizing this rule, plaintiff attempts to fit the document within the provision that evidence of subsequent remedial measures is admissible when offered to show "feasibility, if controverted" (Plaintiff's Memo, p. 68). However, the simple fact is that Boeing does not controvert the feasibility of designing a fitting which would have made

fatigue cracking less likely to occur. *See* McCormick, *Evidence* § 252, at 545 (1954), quoted in 2 Weinstein, *Evidence* ¶ 407[03], at 407-13 (1975):

> "[B]efore admitting the evidence for any of these purposes, the court should be satisfied that the issue on which it is offered is of substantial importance and is actually, and not merely formally, in dispute."

6. *Exhibit No. 22:* Boeing Specifications 5440 Re: Machinery Specifications. Boeing is not quite sure what this document is doing in the plaintiff's appendix of exhibits. Nowhere is the document referred to in plaintiff's moving papers. The document has not been authenticated, and, like any ordinary document, is not self-authenticating. Beyond that, it simply does not appear how from the document it relates in any way to plaintiff's motion.

7. *Exhibit No. 24:* Boeing Metals and Standards Group Metallurgical Examination MS 971; *Exhibit No. 25:* Boeing Metals and Standards Group Metallurgical Examination 6-7611 MS 988; *Exhibit No. 26:* Boeing Metals and Standards Group Engineering Report 6-7600 MS 955; *Exhibit No. 27:* Boeing Metals and Standards Group Engineering Report 6-7611 MS 946; *Exhibit No. 28:* Boeing Metals and Standards Group Engineering Report 6-7771 MS 853; *Exhibit No. 29:* Boeing Metals and Standards Group Engineering Report 6-7611 MS 1010.

All six of these exhibits are Boeing reports of fatigue cracks on the vertical fin fittings of other 707 aircraft which were allegedly discovered subsequent to the crash of plaintiff's aircraft. Despite plaintiff's reference to these as

"post-accident . . . Analysis [*sic*]" there is no indication (and it is not true) that any of these fittings failed in flight.

The exhibits should not be admitted into evidence. Any relevance they might have to show what happened in this case (it is doubtful they have any inasmuch as Boeing concedes that the fitting in plaintiff's aircraft failed along a fatigue crack) is outweighed by the likelihood of prejudice or confusion. That evidence of similar occurrences not rising to the level of a habit should be normally excluded is well settled. *See, e.g., Olin-Mathieson Chemical Corp.* v. *Allis-Chalmers Mfg. Co.*, 438 F.2d 833, 837 (6th Cir. 1971); *Strauss* v. *Douglas Aircraft Co.*, 404 F.2d 1152, 1158 (2d Cir. 1968). This rule has been unaffected by the adoption of the Federal Rules of Evidence. *See* Fed. R. Evid. 401, 403; 1 Weinstein, *Evidence* ¶ 403[04], at 403-23 through 403-31 (1975).

Plaintiff appears to recognize that the reports would not normally be admissible into evidence, for it utilizes them in its memorandum primarily as support for the proposition that fatigue cracks *can* occur in the absence of untempered martensite (Plaintiff's Memo, p. 33-36). If that is their only significance to plaintiff's case, they should be excluded because there is clearly a less confusing and prejudicial way for plaintiff to make this point.

In any event, it is not at all clear to Boeing's counsel how proof of this proposition furthers plaintiff's case. Earlier in its memorandum (pp. 22-24) plaintiff relied heavily on the existence of untempered martensite as showing a "defect" in the fitting. Why ten pages later it wants to disavow any connection between the untempered martensite and the fatigue crack is a mystery to Boeing.

8. *Exhibit No. 30:* (Referred to variously as) BOAC Aircraft Inspection Records (Plaintiff's Memo, p. 36) and Boeing Inspection Records (Plaintiff's Memo, p. 74). This document *(which is a BOAC, not a Boeing, document)* is not authenticated and no showing is made as to who at BOAC prepared it or that it was prepared in the ordinary course of business. It is plainly inadmissible; moreover, its relevance has not been established by plaintiff.

9. *Exhibit No. 35:* BOAC Aircraft Special Check Form. Same objection. Not authenticated; does not qualify as a business record without further showing.

10. *Exhibit No. 36:* Boeing Metals and Standards Group Fin Fitting Failure Analysis 6-7773 MS 146; *Exhibit No. 37:* Boeing Metals and Standards Group Coordination Sheet SU 717 B 443; *Exhibit No. 39:* Boeing Metals and Standards Group Coordination Sheet 6-7741 52 53 C; *Exhibit No. 40:* Boeing Metals and Standards Group Coordination Sheet W 3011; *Exhibit No. 42:* Boeing Metals and Standards Group Engineering Report 6-7773 MS 497; *Exhibit No. 43:* Boeing Metals and Standards Group Engineering Report 6-7773 MS 426 R.

These documents all refer to fatigue cracks found in the general area of the vertical fin on other aircraft. All six of these reports are inadmissible to show that the right-hand fin attach fitting *in this case* was defective.[1] See objections already noted to Exhibits No. 24 through 29, inclusive.

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[1] In any event, the documents do not show any such thing. Exhibit No. 36 is the only one of the six which refers to a crack in the fitting. The others refer to fatigue cracks in the doublers (Exh. No. 40), the fuselage skin (Exh. Nos. 37, 39) and the bolts

Plaintiff, perhaps evidencing its awareness that these documents are inadmissible to show that a defect existed in the present case, focuses on the dates as showing "notice" to Boeing prior to the crash of plaintiff's aircraft. However, the dates also show that these incidents occurred subsequent to the sale of the subject aircraft to BOAC. As demonstrated in Appendix C, notice to Boeing *subsequent to the date of sale of G-APFE* of any "similar problems" is irrelevant to the theory of strict liability in tort—the *only* theory plaintiff is putting forward in this motion.

11. *Exhibit No. 41:* Transcript of Telecon Between Morgan of Boeing and Anderson of BOAC. This statement is utilized by plaintiff's counsel as proof of the discovery prior to the crash of G-APFE of fatigue cracks in the bolts of the FAA aircraft. As such it is inadmissible for the same reasons, set forth in the preceding paragraph, that the Boeing reports of these incidents (Pltf's Exh. No. 42 and 43) are inadmissible.

12. *Exhibit No. 44:* Summary of Percentage of Fin Fitting Fractures; *Exhibit No. 45:* (entitled by plaintiff) "Significant 707, 720 and 727 In-Service Problems." Both exhibits are inadmissible for the reasons set forth in paragraph 7 of this Appendix. Moreover, plaintiff's assertion that Exhibit No. 44 "was prepared by Boeing . . . and approved by Mr. Enright" (Plaintiff's Memo, p. 52) is simply not supported by the record. Morgan stated that this exhibit was "a summary of the findings *of the airlines*" (emphasis supplied). The information contained therein did not come from Boeing, and the summary constitutes neither an admission nor a business record. Furthermore, the cited pages of Mr. Enright's deposition (Pltf's Exh. No. 38, p. 24, l. 1 through p. 26, l. 22 [although page 25 was apparently lost]) refer not to Exhibit No. 44 but to some other document prepared in 1967.

(Exh. Nos. 42, 43). Plaintiff has made no effort to establish any relationship between these other cracks and a fatigue crack in the fitting.

Even as to the fitting crack described in Exhibit No. 36, that report states at p. 1:

"Since the origin of the crack was removed, it is not known whether or not the crack initiated by fatigue."

13. *Exhibit No. 48:* Work Description on Redesigned Fin Fitting Dated 12/6/67. This exhibit is inadmissible under Fed. R. Evid. 407 for the same reason that Exhibit No. 19 is inadmissible.

The above list of objections to some of plaintiff's exhibits is not intended to be exhaustive, nor should it be construed as a waiver of Boeing's right to object to other exhibits not specifically objected to here, if proffered by plaintiff at trial. This is particularly the case with the various deposition transcripts. While there is authority for considering them on the motion for summary judgment, their admissibility at trial would be another matter entirely. Moreover, those portions of the transcripts wherein the deponents refer to hearsay statements other non-Boeing people have made,[2] or to other incidents involving other aircraft,[3] or to modifications to the 707 vertical fin fitting

[2] *See, e.g.*, Plaintiff's Memo, p. 10, lines 12-17 (reference to Hogue deposition).

[3] *See, e.g.*, Plaintiff's Memo, p. 52, line 24; p. 54, line 20 (reference to Morgan deposition).

subsequent to the subject crash[4] are inadmissible for the reasons already stated.

Appendix C

BOAC's Use of Irrelevant Material

At several places throughout its moving papers plaintiff makes crystal clear that, for purposes of this motion, it is proceeding only on the theory of strict liability in tort. See, *e.g.*, Affid. in Support of Pltf's Motion, ¶ 7, p. 3; Plaintiff's Memo, p. 69. Plaintiff has made no claim that it is entitled to summary judgment on its other theories of negligence, implied warranty or express warranty. Why then, Boeing asks, is so much of plaintiff's brief and evidence directed toward matters that have nothing whatever to do with strict liability in tort?

The first example of plaintiff's extensive use of extraneous and irrelevant material is found on pp. 37-39 of its memorandum wherein it refers to so-called "misrepresentations" by Boeing of a twenty year or 50,000 hour service life for 707 aircraft. Ignoring for the moment that plaintiff has totally miscast the import of the evidence on this subject, Boeing submits that the discussion has *nothing whatever* to do with strict liability in tort. If BOAC wants to present this case on an express warranty theory Boeing will defend it on that basis. Plaintiff has not, however, begun to make out a case for summary judgment based on those so-called "representations." With respect to strict liability this evidence is simply irrelevant.

[4] *See, e.g.*, Plaintiff's Memo, p. 40 (reference to Morgan deposition and Hansen deposition).

An even more egregious example of plaintiff's use of extraneous material occurs at pp. 43-55 of its memorandum. Plaintiff's *entire Point V* is concerned totally with events which occurred after sale and delivery of the aircraft to BOAC. These events may be relevant to the so-called theory of a "continuing duty to warn" [1] which may be negligently violated by the manufacturer. They have no relevance to plaintiff's sole avowed theory of strict liability in tort.

Appendix D

BOAC's Misrepresentations of the Evidence

It should be apparent to this Court by now that plaintiff has miscast the import of its evidence at several critical points. As a result many of the conclusionary statements made in the plaintiff's motion, Mr. Pace's affidavit, and at pages 4, 8, 26 and 59 of plaintiff's memorandum—all without references to the record—are unsupported by the evidence.

Plaintiff's attorneys have also misrepresented the evidence on numerous other points. The following catalog of these misrepresentations is intended only to be illustrative:

1. On page 10 of its memorandum, plaintiff states: "Boeing . . . *learned* during its participation in the investi-

[1] *See Braniff Airways, Inc.* v. *Curtiss-Wright Corp.*, 411 F.2d 451 (2d Cir. 1969); *Noel* v. *United Aircraft Corp.*, 342 F.2d 232 (3d Cir. 1964). Boeing does not concede the existence of such a theory under Washington law or any other applicable law. The Washington cases cited by plaintiff on page 61 of its memorandum concern the duty to warn *at the time of sale* and are not in point.

gation of the accident . . . that the tail of the aircraft separated from the aircraft before any other part of the aircraft." As support for this, plaintiff cites the deposition of a Boeing employee, Prater Hogue (Pltff's Exh. No. 7, p. 34, l. 2-11). In fact, what Mr. Hogue testified was that he was once told by another person, Richard M. Morgan, that a Mr. Jones of the Royal Aircraft Establishment had once expressed an opinion that the vertical fin was the first component of the aircraft to fail.[1]

2. On page 22 of its memorandum, plaintiff asserts that "a telex from Mr. Hogue to Boeing's Field Representative Vogwill shortly after the G-APFE crash, on May 27, 1966, acknowledges that untempered martensite was formed during preparation of the hole [by Boeing]". In fact, however, the referenced telex (Pltf's Exh. No. 21) states:

> "Small amount of untempered martensite *may indicate* that fitting was exposed to high local temperature during preparation of the hole by mechanical means." (Emphasis supplied.)

Apparently to plaintiff "may" is the same as "does."

3. On the same page, plaintiff's attorneys state that Mr. Larsen "acknowledged that this [the fracture of the bolt in hole R-1] occurred despite proper maintenance by BOAC." The fact is that Mr. Larsen merely stated that

[1] Curiously, Mr. Jones' opinion was that although the vertical fin failed first, inasmuch as such failure did not occur in the attachment fitting, the fitting crack was irrelevant to the failure of the fin. *See* Boeing Exh. No. D-6, p. 9.

BOAC had used the proper bolt (Pltf's Exh. No. 16, v. I, p. 56, l. 18-25). No mention of "proper maintenance" was made.

4. On page 23, plaintiff states that Mr. Hogue "accepted as accurate" that "the defect of weakened steel [untempered martensite] existed in the aircraft as originally manufactured and delivered to BOAC by Boeing." Mr. Hogue did nothing of the kind. In the cited portion of his deposition (Pltf's Exh. No. 7, p. 20, l. 11-14), Mr. Hogue accepts as "accurate" the metallurgical report (Pltf's Exh. No. 18) which concludes nothing with respect to whether the untempered martensite constitutes a "defect" or whether it existed in the aircraft as originally manufactured.

5. On page 24 of its memorandum, plaintiff states:

> "However, Boeing took no steps to test for the presence of untempered martensite in terminal fittings after holes had been drilled [citing Larsen's deposition]."

This statement is inaccurate. What Mr. Larsen said in his deposition was that he knew of no non-destructive way to test *each fitting* for untempered martensite, but that Boeing did test for untempered martensite by taking random samples of the fittings.

6. On page 26 of its memorandum, plaintiff states that "the fittings and bulkhead . . . were not capable of carrying loads placed on them during normal flight" [citing Morgan deposition in a KC-135 case]. In fact, what Morgan stated was:

"Q. All right, Mr. Larsen and Mr. Haydan advised you that these many, many cracks were occurring because the fitting in the surrounding structure was not strong enough to carry the normal and usual flight load? Is that, in essence, what they said?

"A. As I recall, no, that was not the case, but what they were worried about was getting into excessive loading due to abnormal operations."

7. On page 30 of its memorandum, plaintiff states that "the machining and reaming of the fin terminal bolt holes by Boeing caused the fitting to fatigue on *all* 707 aircraft" (emphasis supplied). That statement is not supported by the cited deposition and is, as plaintiff knows, untrue.

8. On page 33, plaintiff states that Mr. Morgan testified that "machining and reaming of fittings by Boeing undeniably contributed to the fatigue of the fittings." Mr. Morgan said no such thing.

9. On the same page, plaintiff states that "Mr. Morgan testified in 1972 that *the fractures*, due to underdesign of the fitting, *would* have taken place with or without the presence of untempered martensite . . . ." (Emphasis supplied.) The reference is inaccurate. Morgan is not even testifying about this particular aircraft, does not say anything about "underdesign," and does not say that any fractures "would have taken place with or without the presence of untempered martensite" but rather only that one "*can* get fatigue cracks . . . without the presence of untempered martensite."

10. On page 36 of its memorandum, BOAC includes the following statement:

"Boeing has admitted that the subject BOAC aircraft was inspected and deemed airworthy on January 28, 1966, two months before the crash [citing Larsen deposition]."

The *entire* cited portion of Mr. Larsen's deposition is as follows:

"Mr. Palmquist [attorney for the estates of certain passengers]: BOAC has presented us with an inspection record which is dated, I believe, January 1966, and in which they [BOAC] certify that the airplane was airworthy. That would be about two months before the accident."

Mr. Larsen did not make any statement regarding the accuracy of the BOAC records.

11. A egregious distortion occurs on page 41 of plaintiff's memorandum, wherein its attorneys state:

"Boeing has established that there was nothing unique [citing Hogue deposition] nor unusual [citing Hogue deposition] about the weather conditions on March 5, 1966 which existed at the time the subject aircraft disintegrated in flight [citing Knutson deposition]."

These witnesses said nothing of the kind about the weather conditions at Fuji on the day of the accident. In the cited portions of his deposition, Mr. Hogue testified as follows:

"Q. Well, there is nothing unique about roll clouds around a mountain, is there?

"A. No.

"Q. There is nothing unique is there, in a pilot knowing what happens to high velocity winds when they strike a peak such as Mt. Fuji which rises so dramatically from a low elevation up to some 12,000 feet?

"A. No. * * *

"Q. Mr. Knutson, who testified here yesterday, said that even clear air turbulence should at all times be predictable by a pilot who briefs himself properly; would you agree with that statement?

A. If Mr. Knutson said so, I would agree with him."

Mr. Knutson's testimony is as follows:

"Q. Would you expect when you encountered severe air turbulence to see some kind of a cloud buildup over a mountain range or a mountain peak, called a roll cloud?

"A. Not necessarily. The buildup of the roll cloud, or lenticular-type cloud, would be only occurring when temperature or moisture conditions were just right for such a formation.

"Q. But that is a formation that is usually identified with either severe or extreme turbulence?

"A. Yes. I think cloud formations that are of this type in the mountains you can expect high turbulence. I don't know what degree can necessarily be expected.

"Q. Is that type of a cloud formation generally found on the lee side of a mountain range or a mountain peak?

"A. Yes."

This Court can readily see that the cited depositions in no way support plaintiff's statements. Boeing and BOAC both agree that the weather conditions at Fuji on the day of the accident were extremely abnormal.

The above is not intended as a complete list of the instances in which plaintiff's attorneys have twisted the evidence to suit their purposes. However, Boeing feels that it has demonstrated to the Court how inappropriate this case is for summary judgment for the plaintiffs.

BOAC's Supplemental Memorandum in Support of Its Motion for Summary Judgment and in Opposition to Boeing's Motion

UNITED STATES DISTRICT COURT

WESTERN DISTRICT OF WASHINGTON AT SEATTLE

Nos. C74-257S and C74-380S

BRITISH OVERSEAS AIRWAYS CORPORATION,

Plaintiff,

vs.

THE BOEING COMPANY,

Defendant.

PRELIMINARY STATEMENT

Plaintiff British Overseas Airways Corporation (hereinafter BOAC) moved this Court on June 4, 1976 for Partial Summary Judgment on the issue of liability. Defendant The Boeing Company (hereinafter Boeing) thereafter cross-moved this Court for Summary Judgment on August 16, 1976.

This Memorandum of Reasons and Authorities and Supporting Papers is submitted (1) in Opposition to Boeing's Motion for Summary Judgment and (2) in Further Support of plaintiff BOAC's Motion for Partial Summary Judgment on the grounds that the purported factual evidence proffered by defendant Boeing in its Motion for Summary Judgment should be stricken from consideration by this Court for failure to comply with Federal Rules Civil Procedure 56 in that Boeing's Motion papers are

BOAC's Supplemental Memorandum in Support of Its Motion for Summary Judgment and in Opposition to Boeing's Motion

totally devoid of affidavits of fact as would be admissible in evidence under the Federal Rules of Civil Procedure and The Federal Rules of Evidence.

STATEMENT OF ARGUMENT

BOAC has moved for partial summary judgment on the issue of liability on the grounds that no genuine issue of material fact exists, specifically:

1. Boeing designed and manufactured the subject aircraft which was sold to plaintiff BOAC in 1960;

2. The subject aircraft was defective in both design and manufacture at the time it was sold to BOAC;

3. The defective design and manufacture caused the vertical tail fin of the aircraft to separate from the aircraft in flight, resulting in the crash in which all persons perished and in which the aircraft was destroyed. BOAC Memorandum of Reasons and Authorities—4 [hereinafter BOAC Memo].

These three specific allegations comprise the only areas where a factual dispute could arise.

As to the first contention there is clearly no question that the subject aircraft G-APFE was a Boeing manufactured product.

BOAC's second contention is based on the presence of a fracture in the terminal fin fitting which stemmed, it has been admitted, from defective design and manufacture of the aircraft. This defect was inherent in the under design of the entire failed fin terminal fitting and bulkhead. Significantly, Boeing admits the presence of the fracture at

several points in its Memorandum (p-3), that this fracture existed prior to the accident (Boeing Memorandum—7 and Appendix B-3) and that this fitting failed at the fracture. Boeing attempts to obscure this admission by arguing that the fracture did not exist at the time of the sale of the subject aircraft. However, Boeing offers no factual proof to rebut the evidence offered by BOAC that it was the defective nature of the fin terminal fitting and bulkhead which produced the fracture.

Boeing concedes the casual connection between the defectively designed fin terminal fitting and bulkhead and the subsequent fracture of the fin fitting:

> "Boeing does not controvert the feasibility of designing a fitting which would have made fatigue cracking less likely to occur."
>
> Boeing Memorandum, Appendix B-2.

As to BOAC's second contention, Boeing has not offered any proof in either the two affidavits or annexed exhibits to refute the existence of the defect.

Boeing has not disputed the specific testimony, admissions and documentary evidence by showing contrary proof but has argued on the basis of unsupported assertions by its counsel in memorandum form. As will be more fully set forth, *infra,* this procedure by Boeing is legally insufficient to put a material fact in issue under the standards established by Rule 56 of the Federal Rules of Civil Procedure.

BOAC's third factual contention is that the fractured fin fitting caused the structural failure of the fin terminal. In support of this contention BOAC relies upon Boeing's

Answer to the Complaint, Answers to Interrogatories, eleven depositions of nine current and former Boeing employees and Boeing internal investigations and reports, made and maintained in the regular and usual course of business, produced and acknowledged at the depositions of these employees, at which counsel for Boeing were present. Boeing has not disputed the deposition testimony of these witnesses at the depositions nor has it disputed their admissions and authentication of documents.

Boeing has thus conceded the accuracy of their witnesses' admissions that the subject aircraft's fin terminal fitting and bulkhead were underdesigned and not capable of carrying the loads placed on them during normal use.

Boeing, in support of its motion for summary judgment and in opposition to BOAC's motion for partial summary judgment offered only the affidavit of one of Boeing's attorneys, who attended the recent depositions of present and former BOAC employees, and the affidavit of a Boeing structures engineer. Neither of these two affidavits meet the specific requirements of Rule 56(e).

The affidavit of the Boeing attorney attempts to direct the court's attention to its Memorandum and incorporate the allegations of fact therein as those uncovered at the recent depositions of present and former BOAC employees. The affidavit of the Boeing structures engineer purports to offer an opinion as to the cause of the crash. Both affidavits are clearly defective under Rule 56(e) to raise the facts based on personal knowledge and inadmissible on a motion for summary judgment. Accordingly, these affidavits should be disregarded and stricken from the consideration of the respective motions.

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Since the Boeing affidavits are patently defective to show a genuine issue as to any material fact the Memorandum cannot serve as the vehicle for creating such. Boeing does not offer rebuttals to the specific factual allegations of BOAC based on admissions made during depositions by Boeing engineers, service personnel and accident investigators. Boeing only offers the affidavit of one of these people in support of its motion for summary judgment and that affidavit is not of fact but merely of opinion, totally unsupported by fact. Nowhere does Boeing attempt to refute the specific testimony of these representatives on the within motion. The one affiant, Howard Smith, fails to explain his prior testimony that the fitting on G-APFE was below capacity [BOAC Memo—30] but rather offers a narrow opinion as to the cause of the crash based solely on a report, not submitted, in which he in no way participated.

It is an elementary principle of summary judgment procedure that the failure to oppose by factual proof has the effect of an admission for purpose of the motion. Consistent with that principle is the requirement that specific allegations of fact must be specifically refuted. General averments of denials and "theories" as to causation cannot create a genuine material issue of fact, required by Rule 56. Accordingly, Boeing's motion for summary judgment and opposition to BOAC's motion for partial summary judgment on the issue of liability is rendered fatally defective and BOAC's motion should be granted on Boeing's default of proof.

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BOEING HAS FAILED TO OFFER EVIDENCE AS REQUIRED BY RULE 56 OF THE FEDERAL RULES CIVIL PROCEDURE TO CONTROVERT BOAC'S MOTION FOR SUMMARY JUDGMENT

BOAC's papers in support of its motion have established factually that BOAC is entitled to partial summary judgment on the issue of liability. The opposition papers and motion by Boeing for summary judgment have failed to controvert the facts asserted in BOAC's motion and are defective under Rule 56(e) of the Federal Rules of Civil Procedure to create a dispute as to the factual issues in the case, much less a *genuine* factual issue.

The operative provision specifying the types of evidentiary support appropriate for consideration on a motion for summary judgment reads:

> "The judgment sought shall be rendered forthwith if the pleadings, depositions, answers to interrogatories, and admissions on file, together with the affidavits, if any, show that there is no genuine issue as to any material fact and that the moving party is entitled to a judgment as a matter of law." Fed. R. Civ. P. 56(c).

In the instant action plaintiff BOAC made its motion for summary judgment based on the defective design and manufacture by Boeing of the subject aircraft G-APFE and seeks recovery on the doctrine of strict tort liability as applied in Washington. *See Ulmer* v. *Ford*, 75 Wash. 2d 522, 452 P.2d 729 (1969); Restatement (Second) of Torts §402A (1965). Defendant Boeing in its Memorandum, at pages 9 and 11, questions the applicability of Washington substantive law. Although this court must apply the law of the transferor forum in a case transferred pursuant to

28 U.S.C. §1404(a), under either of the two transferor jurisdictions, California or New York, the substantive conflicts rules would apply the law of Washington as the forum with the most significant contacts or governmental interest in the case. The aircraft was designed and manufactured in Washington, the contract of sale was consummated in Washington and the delivery of the aircraft to BOAC took place in Washington. *Babcock* v. *Jackson,* 12 N.Y. 2d 473 (1963); *Neumeier* v. *Kuehner,* 31 N.Y. 2d 121 (1972); *Hurtado* v. *Superior Court,* 11 Cal. 3d 574 (1974).

Although the initial pleadings generally frame the factual issues in controversy, it is clear that something more than the allegations in a pleading must be shown to support or defeat a motion for summary judgment. *Smith* v. *Mack Trucks, Inc.,* 505 F.2d 1248, 1249 (9th Cr. 1974); *Byrnes* v. *Mutual Life Insurance Company of New York,* 217 F.2d 497, 500 (9th Cir. 1954); *Koepke* v. *Fontecchio,* 177 F.2d 125, 127 (9th Cir. 1949); *Lindsey* v. *Leavy,* 149 F.2d 899, 902 (9th Cir. 1945); *Piantadosi* v. *Loew's Inc.,* 137 F.2d 534, 536 (9th Cir. 1943); *Shotwell* v. *United States,* 163 F.Supp. 907, 912 (E.D. Wash. 1958).

Rule 56 provides for the disposition of a motion for summary judgment upon evidence which may properly be used at trial. *See,* C. Wright & A. Miller, Federal Practice and Procedure, Civil §2712 (1973) [hereinafter referred to as Wright & Miller].

To create a factual issue the procedure requires that the evidence be verified e.g. depositions, answers to interrogatories, and affidavits, or authenticated in some manner, e.g. exhibits and trial records.

Plaintiff BOAC has offered ample deposition testimony in support of its motion for summary judgment which is

replete with factual admissions and also provides the authentication necessary for the consideration of exhibits originally introduced at the time the depositions were taken. Defendant Boeing has not controverted these factual assertions but rather has offered two affidavits based on hearsay and opinion statements (See Defendant Boeing's Exhibit Nos. D-8 and D-9) supplemented by a memorandum of conclusory statements concerning its "theory" of the cause of the crash.

Defendant Boeing has accompanied its motion with two affidavits. Howard Smith, presently Chief of the Structures Research in the Structures Technology Staff for Boeing, filed an affidavit in support of Boeing's motion for Summary Judgment and offered his opinion as to the breakup of the aircraft. (Boeing Exhibit No. D-8). John D. Dillow, one of the attorneys for Boeing, filed an affidavit in support of Boeing's Motion for Summary Judgment wherein he characterizes, incorrectly, the testimony of several BOAC witnesses whose depositions were recently taken.

That these two affidavits are patently defective is readily apparent. Both of these affidavits fail to demonstrate personal knowledge of the facts of the defect and crash, and critically, do not show the competence of the affiant to testify to the matters referred to as required by Rule 56(e).

> "Supporting and opposing affidavits shall be made on personal knowledge, shall set forth such facts as would be admissible in evidence, and shall show affirmatively that the affiant is competent to testify to the matters stated therein."

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In *United States* v. *Dibble,* 429 F.2d 598 (9th Cir. 1970), the United States Court of Appeals for the Ninth Circuit found that an affidavit in support of a motion for summary judgment that was not made on personal knowledge: (1) did not set forth facts admissible in evidence, (2) did not show that affiant was competent ot testify to the maters contained in the affidavit, (3) the documents attached to the affidavit were unauthenticated and hearsay, (4) did not comply with Rule 56 and thus, could not be used to determine a motion for summary judgment. The Court stated:

> "A summary judgment is neither a method of avoiding the necessity for proving one's case nor a clever procedural gambit whereby a claimant can shift to his adversary his burden of proof on one or more issues." (Adickes v. S.H. Kress & Co. (1969) 398 U.S. 144, 90 S.Ct. 1598, 26 L.Ed. 142). 429 F.2d at 601.

The foundation necessary for the admissibility of an affidavit deemed essential by the Ninth Circuit is clearly lacking here. Neither affiant Dillow nor affiant Smith were competent to provide the necessary authentication to the exhibits used in support of Boeing's motion.

> "The foundation is laid for receiving a document in evidence by the testimony of a witness with personal knowledge of the facts who attests to the identity and due execution of the document, and, where appropriate, its delivery. An official record is authenticated by the testimony of a witness who knows and attest to the facts stated in Rule 44 of the Federal Rules of Civil Procedure." 429 F.2d at 602.

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Where affidavits proffered on a summary judgment motion are not made on personal knowledge or do not contain admissible evidence, as in this case hearsay, they are subject to a motion to strike. *McSpadden* v. *Mullins,* 456 F.2d 428 (8th Cir. 1972). In *McSpadden,* plaintiff moved to strike an affidavit by a university president expressing the opinion that plaintiff was not qualified for appointment as a full time instructor. The affidavit was based not on personal knowledge but on an incorporated memorandum from the chairman of the music department. The United States Court of Appeals for the Eighth Circuit reversed the denial of plaintiff's motion to strike and held that the affidavit was hearsay and inadmissible. 456 F.2d at 430.

The situation presented by the instant action is strikingly analogous to the *McSpadden* case. Howard Smith's affidavit is based not on personal knowledge but on the application of "general aerodynamic principles" to a report concerning the crash of G-APFE prepared by the Japanese investigating team. (Boeing Exhibit No. D-8 at 2). Thus, Smith's affidavit is likewise hearsay and clearly inadmissible on a motion for summary judgment.

A further review of Smith's affidavit discloses another fatal flaw. Not only is the affidavit inadmissible because it is not based on personal knowledge but it is also inadmissible since it purports to offer an opinion as to the cause of the crash. It is clear that an opinion affidavit cannot raise an issue of fact under Rule 56 and has no effect on a motion for summary judgment. *Elliot* v. *Massachusetts Mutual Life Insurance Company,* 388 F.2d 362, 366 (5th Cir. 1968); *Engelhard Industries, Inc.* v. *Re-*

search Instrumental Corporation, 324 F.2d 347, 351 (9th Cir. 1963); *Alger* v. *United States,* 252 F.2d 519, 521 (5th Cir. 1958); *G.D. Searle & Co.* v. *Chas. Pfizer & Co.,* 231 F.2d 316, 318 (7th Cir. 1956). Especially, where as here, the affiant did not participate in the investigation of the accident, any opinion would be speculation based on hearsay. [Smith's deposition (Exhibit "9") P. 5:5-7].

Boeing begs the indulgence of this Court to accept the affidavit of Mr. Dillow because at this time the transcripts of the depositions of the BOAC present and former employees are not yet available. (Boeing Exhibit No. D-9 at 1.). What Boeing neglects to point out is that the eleven depositions of the nine present and former Boeing employees, relied on extensively by BOAC in its motion, have been available for quite some time.

Not only does Boeing fail to make use of the existing depositions of its own employees, either to support its motion or to oppose the BOAC motion, but the affidavit of Howard Smith, a Boeing employee whose deposition was available, is noticeably devoid of any refutation of the Boeing deposition testimony relied on by BOAC. The BOAC motion refers to Smith's testimony that the fitting was 40% below capacity, [BOAC Memo—30], and that the existence of cracking bolts was known at least as early as 1964. [Boeing Memo—50]. Neither of these facts is discussed in Smith's affidavit. Finally, it was Smith who admitted that the terminal fitting and surrounding structure were not designed strong enough to take the loads placed on them. [Morgan deposition (Exhibit "15") (Vol. 111) P. 142:10—P.143:12]. None of this was mentioned in Smith's affidavit.

Boeing's treatment of Smith's deposition testimony is typical of the treatment accorded to the other eight Boeing employees, depositions extensively relied upon by BOAC. Boeing does not offer specific transcript references to refute the facts contended by BOAC. This approach to the evidence is wholly inadequate for purposes of Rule 56. "[M]ere general allegations which do not reveal detailed and precise facts will not prevent the award of summary judgment." *Liberty Leasing Co.* v. *Hillsum Sales Corporation,* 380 F.2d 1013, 1015 (5th Cir. 1967); *See also, Chapman* v. *Rudd Paint & Varnish Company,* 409 F.2d 635 (9th Cir. 1969); *International Longshoremen's & Warehousemen's U.* v. *Kuntz,* 334 F.2d 165 (9th Cir. 1964).

Although Mr. Dillow was present at the taking of the depositions of the BOAC employees, his affidavit paraphrasing testimony is hearsay as well as inaccurate and misleading. Counsel for BOAC who were present at the depositions specifically reject his affidavit as completely inaccurate. At this juncture counsel for BOAC affirmatively refrains from submitting its own summary of depositions in the belief that this would be as defective and incompetent as the affidavit of Mr. Dillow and would be of little aid to the court in the resolution of these motions. It is instead respectfully requested that the Dillow affidavit be disregarded in its entirety, in the absence of proper submission of deposition testimony.

It is for this reason that Rule 56 requires affidavits be made on personal knowledge with specific references to the facts. The United States Court of Appeals for the District Court of Columbia Circuit stressed the need for verified and authenticated evidence on a motion for summary judgment.

> "Thus, the extra-pleading matters presented must be either 'depositions' 'admissions' or 'affidavits'. All three possess certain characteristics which make them fitting instruments for cutting through a possible maze of false, illusory or collateral issues raised by loosely-drawn pleadings. As the sworn statements of those who have first-hand knowledge of that about which they speak, they partake not only of the ceremonial quality of testimony in open court, but also of some of the guarantees of trustworthiness which characterize such testimony." *Sardo* v. *McGrath* 196 F.2d 20, 22-23 (D.C. Cir. 1952).

It is also well established that an attorney's affidavit which is not based on personal knowledge and is hearsay is inadmissible for consideration on a motion for summary judgment. *Local Union No. 490, U.R., C., L & P. Wkrs.* v. *Kirkhill Rubber Co.*, 367 F.2d 956 (9th Cir 1966); *Chambers* v. *United States*, 357 F.2d 224, 228 (8th Cir. 1966); *Hoston* v. *J. R. Watkins Co.*, 300 F.2d 869 (9th Cir. 1962); *Minnesota Mining & Mfg. Co.* v. *United States Rubber Co.*, 279 F.2d 409 (4th Cir. 1960); *Maddox* v. *Aetna Casualty And Surety Company*, 259 F.2d 51, 53 (5th Cir. 1958); *Inglett & Company* v. *Everglades Fertilizer Company*, 255 F.2d 342, 349-350 (5th Cir. 1958). *Mercantile Nat Bank at Dallas* v. *Franklin Life Ins. Co.*, 248 F.2d 57 (5th Cir. 1957).

The Court in *Inglett & Company* v. *Everglades Fertilizer Company*, questioned the use of an attorney's affidavit as the "vehicle by which the 'undisputed' facts are put before the Court." 255 F.2d 342, 349 (5th Cir. 1958). In

Mercantile Nat. Bank at Dallas v. *Franklin Life Ins. Co.*, the court disregarded the affidavit of attorneys who did not have personal knowledge of the facts, finding such to be of "no probative value." 248 F.2d 57, 59 (5th Cir. 1957).

The United States District Court for the Southern District of New York took a dim view of piecing together an argument through the use of "alleged facts, comment, inference, argument and explanation." The Court described this technique as an "inherently unsound practice." *Universal Film Exchanges, Inc.* v. *Walter Reade, Inc.* 37 F.R.D. 4,5 (S.D.N.Y. 1965). As pointed out by another court:

> "The developing case law reflects an attitude of judicial disaprobation of the practice of submitting affidavits which embody the sworn statements of counsel of his conclusions or of what another person has told him." *Becker* v. *Koza*, 53 F.R.D. 416, 418 (D. Neb. 1971).

Judical authority applicable to this action makes clear that a legal memorandum which contains factual assertions is not evidence within the summary judgment context. *Smith* v. *Mack Trucks Inc.*, 505 F.2d 1248 (9th Cir. 1974); *Proctor* v. *Sagamore Big Game Club*, 265 F.2d 196 (3d Cir. 1959), *cert. denied*, 361 U.S. 831 (1959) *Brockins* v. *Chrysler Corporation, Dodge Main Division*, 381 F.Supp. 563 (E.D. Mich. 1974); *United States* v. *Malkin*, 317 F.Supp. 612, 614 (E.D.N.Y. 1970); *Schoenbaum* v. *Firstbrook*, 268 F.Supp. 385 (S.D.N.Y. 1967), *aff'd* 405 F.2d 200 (2d Cir. 1968), *cert. denied*, 395 U.S. 906 (1968); *United States* v. *Jones*, 155 F.Supp. 52 (M.D. Ga. 1957); *Lane* v. *Greyhound Corp.*, 13 F.R.D. 178 (E.D. Ky. 1952); *Allen* v. *Radio Corporation of America*, 47 F.Supp. 244 (D. Del 1942).

In a strikingly similar situation to the case at bar the United States District Court for the District of Columbia rejected the use of general factual allegations in memorandum form, finding them to be of no evidentiary value.

> "Defendants also resist the plaintiff's motion for summary judgment by asserting in both of its memoranda of points and authorities that certain genuine issues of material fact exist in this litigation. The fact issues claimed to exist are not properly set forth in the answer or by means of affidavit but are merely listed at page 7 of both of defendant's memoranda. Furthermore, this list does not consist of specific allegations or statements of fact but rather they are merely speculative questions as to what procedures might or might not have been followed by the Commission in instituting this action. By reason of their source and their nature, these questions do not form a sound basis for determining that a genuine issue of material fact exists in this case. Even factual statements made in legal memoranda or points and authorities cannot be given the dignity of allegations in the pleadings or statements made by affidavit or by deposition." *United States* v. *Lot 800 In Square 1928 Etc.*, 169 F.Supp. 904, 908 (D. D.C. 1959).

Since Boeing has been unable to come up with specific factual evidence, admissible under Rule 56, Boeing has resorted to "piecing" together its factual contentions of "alleged facts, comment inference, argument and explanation" is the form of a legal memorandum. *Universal Film Exchange, Inc.* v. *Walter Reade, Inc., supra,* 37 F.R.D. at 5.

Professors Wright & Miller explain the defective nature of the factual assertions contained in brief form.

> "Nor can the motion be defeated by factual assertions in the brief of the party opposing it, inasmuch as documents of this character are self-serving and are not probative evidence of the existence or nonexistence of any factual issues." *Wright & Miller*, §2723.

Thus, under Rule 56 a party supporting or opposing a motion for summary judgment must bring its evidentiary proof within the requirements of the Rule. Affirmative proof must meet the same standards of admissibility that would be required at trial. Clearly, since a brief or memorandum cannot be used as evidence at a trial it follows that it cannot constitute evidence for consideration on a motion for summary judgment.

> "In marked contrast, memoranda of points and authorities are no more than trial briefs which must be filed with *each motion* presented to the District to the District Court. They must state 'the specific points of law and authorities to support the motion' and are expressly not made part of the record. Such memoranda are neither mentioned in Rule 56 nor, in our view, may they be classed inferentially among the documents in which extra-pleading matters may be presented for purposes of summary judgment. Neither the Federal Rules nor custom at the bar contemplate transformation of legal memoranda into a new vehicle of factual conflict." *Sardo* v. *McGrath, supra,* 196 F.2d at 23.

BOAC's Supplemental Memorandum in Support of Its Motion for Summary Judgment and in Opposition to Boeing's Motion

CONCLUSION

Accordingly, based on BOAC's Motion for Partial Summary Judgment and the within Supplemental Memorandum of Reasons and Authorities (1) in Further Support of its Motion for Partial Summary Judgment against The Boeing Company and (2) in Opposition to Boeing's Summary Judgment Motion against BOAC, BOAC's Motion for Partial Summary Judgment against The Boeing Company should be granted in its entirety and Boeing's Motion for Summary Judgment should be denied in its entirety on the grounds that Boeing has totally failed to comply with the clearly set requirements of Rule 56 of the Federal Rules of Civil Procedure, both in support of its Motion for Summary Judgment and in its purported opposition to BOAC's Motion for Partial Summary Judgment.

Dated: Septembr 3, 1976

/s/ WILLIAM L. PARKER
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—and—

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Boeing's Reply Brief in Support of Its Motion for Summary Judgment

UNITED STATES DISTRICT COURT

WESTERN DISTRICT OF WASHINGTON AT SEATTLE

Nos. C74-257S and C74-380S

BRITISH OVERSEAS AIRWAYS CORPORATION,

Plaintiff,

v.

THE BOEING COMPANY,

Defendant.

As BOAC itself points out, a motion for summary judgment cannot "be defeated by factual assertions in the brief of the party opposing it." 10 C. Wright & A. Miller, *Federal Practice and Procedure* § 2723 at 489 (1973). BOAC did not (and presumably cannot) introduce any evidence explaining or disavowing the admissions[1] of its own employees that the subject crash was caused by extreme turbulence creating gust loads in excess of what the aircraft was designed to withstand. Not one affidavit, deposition statement or other piece of evidence submitted by BOAC ties the fatigue crack to the cause of the crash. It is now apparent that BOAC has no such evidence and that Boeing is entitled to summary judgment.

We will review the uncontroverted evidence.

First, the breakup of the aircraft was almost instantaneous. The right wing, forward fuselage, engines, ver-

[1] See Boeing Exhibits Nos. D-1, D-2, D-3, D-4, D-5, D-7 and D-10.

tical fin and horizontal stabilizers all separated in flight from the remainder of the aircraft. Boeing Exh. D-1, pp. 1-2.

Second, *BOAC's* Air Safety Committee concluded that the aircraft failed because it was subjected to gust loads in excess of what the aircraft was designed to withstand. Exh. D-2, p. 1. BOAC's official accident report, as well as the accident report it submitted to the International Air Transport Association, reached the same conclusion. Exhs. D-1, 5. There is no suggestion in any of the BOAC reports of any causal connection between the crack in the fitting and the subject crash. Furthermore, neither the British nor Japanese governments concluded that there was a connection. Exhs. D-1, 6. Mr. Folliard, BOAC's Chief Inspector of Accidents at the time of the Fuji accident, testified that BOAC accepted the Japanese conclusion as to probable cause. Dillow Affid., ¶ 5.

Third, at the recent London depositions, BOAC's present Chief Inspector of Accidents and the Chairman of British Arways' Air Safety Committee (BOAC's successor) testified that they did not disagree with Boeing's statement that the crack was irrelevant to the cause of the crash and knew of no person or document which had ever expressed a contrary opinion. Dillow Affid., ¶¶ 4, 7.

Finally, Boeing's expert, Howard W. Smith, states categorically that the crack was irrelevant to the cause of the crash. Smith Affid., ¶ 3. The evidence is uncontroverted that such crack was simply not a factor in the *cause* of the crash.

Boeing does not admit that the fitting was defective. See Boeing's Opening Brief, pp. 11-12; Appendix A, pp. 4-5;

Appendix D, pp. 1-2. But even if it had been defective and even if the vertical fin had been the only structural member to fail (i.e. the right ring, the four engines, the fuselage and the horizontal empennage had not broken), BOAC still could not meet its burden of proof in view of its admission that the aircraft encountered gusts that exceeded the design strength of the aircraft.

The test for determining the existence of proximate cause is set forth in sections 431 and 432 of the *Restatement (Second) of Torts.*[2] Directly on point is Illustration 2 to section 432 of the *Restatement*:

> "A dams a stream running through his own land. The dam is negligently constructed in that it is not sufficiently strong to confine the water from the freshets which occur from time to time in the spring. A sudden cloudburst of unprecedented severity sweeps the dam away, causing the water collected by it to overflow the land of B. The flood caused by the cloudburst is so great that it would have burst the dam even had it been properly constructed. A's negligent construction of the dam is not a cause of the inundation of B's land."

See also Stoneman v. *Wick Construction Co.*, 55 Wn.2d 639, 349 P.2d 215 (1960) (defective welds in structural steel work in retaining wall not a substantial factor in bringing about failure of the wall where design was such that wall would have failed anyway); *Lekas & Drivas, Inc.* v. *Goulondris*, 306 F.2d 426 (2d Cir. 1962) (improper storage not a substantial factor in bringing about spoilage of cheese

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[2] See *Moyer* v. *Clark*, 75 Wn.2d 800, 454 P.2d 374 (1969).

where abnormally high temperatures would have ruined cheese even if properly stored.

BOAC's answering brief deals with none of these points. There are, however, two points—both peripheral—which BOAC does raise to which Boeing ought to respond. The following paragraphs demonstrate that BOAC's objections to the affidavits of John D. Dillow (Boeing Exhibit No. D-9) and Howard W. Smith (Boeing Exhibit No. D-8), which are only two of the ten exhibits submitted by Boeing in support of its motion, are without merit.

1. *The Dillow Affidavit.*

As Boeing explained in its memorandum, in order to have Boeing's and BOAC's motions for summary judgment heard together, it was necessary for Boeing to prepare and file its moving papers before the transcripts of the London depositions were available. For this reason, Boeing used the affidavit of Mr. Dillow to establish that BOAC witnesses in London had authenticated the BOAC Air Safety Reviews (extracts from which appear as Boeing Exhibits Nos. D-1, D-2, D-3, D-4 and D-7), the BOAC accident report submitted to IATA (Boeing Exhibit No. D-5) and the so-called "Jones report" (Boeing Exhibit No. D-6).[3]

Mr. Dillow also set forth the substance of certain testimony by the BOAC witnesses as to whether these witnesses now disagreed with certain statements found in BOAC's Air Safety Reviews (they did not). While it would be better to have the transcripts of these depositions,[4] Mr. Dillow's affidavit is competent and admissible evidence. *Meyers* v. *United States,* 171 F.2d 800 (D.C. Cir. 1948), *cert. denied,* 336 U.S. 912 (1949); *see also State* v. *Bixby,* 27 Wn.2d 144, 165, 177 P.2d 689 (1947). The cases cited by BOAC rejecting attorneys' affidavits are not in point. Unlike the affiants in those cases, Mr. Dillow does have first-hand knowledge of testimony given by the BOAC witnesses. He was there, a point BOAC concedes.

Significantly, while BOAC (in its memorandum, rather than by affidavit) states that "[c]ounsel for BOAC who were present at the depositions specifically reject [Mr. Dillow's] affidavit as completely inaccurate," it nowhere gives even one example or particular in support of this unsworn assertion.

2. *The Smith Affidavit.*

BOAC attacks the Howard Smith affidavit as "not based on personal knowledge" and "opinion." Both objections are fanciful. Mr. Smith is an expert. Nothing in the law could be better settled than that an expert is entitled to offer opinions based on either his own personal observations or the evidence given by others. Here, Mr. Smith based his expert opinion on the evidence of others: BOAC's admissions contained in its Accident/Incident Report and, particularly, the statements of BOAC's air safety investigator *who was present in Japan* as to the major structural failures which he observed. Smith Affid., ¶2.

The affidavit of an expert is admissible in support of (or in opposition to) a motion for summary judgment.

[3] BOAC nowhere suggests that these exhibits are not authentic.

[4] Boeing now understands that copies of these transcripts are being air expressed to its attorneys tomorrow, Thursday, September 9, and Boeing should be able to submit copies of the deposition transcripts to the Court by the end of the week.

Markwell v. *General Tire & Rubber Co.*, 367 F.2d 748 (7th Cir. 1966). In any event, Smith's opinion is no different from what BOAC has admitted—that the crash was caused by the aircraft encountering turbulence which imposed gust loads in excess of what the aircraft was designed to withstand. As to these admissions, no opinion rule applies. *Owens* v. *Atcheson, Topeka & Santa Fe Ry. Co.*, 393 F.2d 77, 79 (5th Cir.), *cert. denied*, 393 U.S. 855 (1968).

CONCLUSION

Boeing has rebutted BOAC's objections to Exhibits Nos. D-8 and D-9 not because these exhibits are vital to Boeing's motion but because these are the only respects in which BOAC has even attempted to attack Boeing's presentation. The fact is, however, that even if these exhibits are disregarded there is still no genuine issue of material fact. The evidence is clear and uncontradicted that no defect in the aircraft caused the crash. Accordingly, Boeing is entitled to summary judgment.

DATED this 8th day of September, 1976.

Respectfully submitted,

PERKINS, COIE, STONE,
OLSEN & WILLIAMS
Keith Gerrard
John D. Dillow
Richard C. Coyle

By /s/ JOHN DILLOW
John D. Dillow
The Boeing Company
Attorneys for Defendant

CERTIFICATE OF SERVICE

I hereby certify that on September 8, 1976 copies of the foregoing Boeing's Reply Brief in Support of Its Motion for Summary Judgment were served upon the plaintiff by delivery to:

WILLIAM PARKER, Esq.
BOGLE & GATES
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Seattle, Washington 98164

and mailing, postage prepaid to:

RONALD E. PACE, Esq.
1251 Avenue of the Americas
New York, N. Y. 10020

/s/ JOHN D. DILLOW
John D. Dillow

Boeing's Supplemental Memorandum in Support of Its Motion for Summary Judgment

UNITED STATES DISTRICT COURT

WESTERN DISTRICT OF WASHINGTON AT SEATTLE

Nos. C74-257S and C74-380S

BRITISH OVERSEAS AIRWAYS CORPORATION,

Plaintiff,

v.

THE BOEING COMPANY,

Defendant.

In Boeing's Reply Brief in Support of Its Motion for Summary Judgment, Boeing informed the Court that transcripts of certain depositions of BOAC employees recently taken in London were being air expressed to Boeing's counsel in Seattle. Reply Brief p. 2. Those deposition transcripts have now arrived, and are enclosed herewith.

Since the deposition transcripts were not available at the time of the filing of Boeing's Motion for Summary Judgment, the affidavit of one of the attorneys in attendance at those depositions, John D. Dillow, was submitted to the Court to establish the substance of the testimony given by certain of the deponents. Thereafter, BOAC's counsel generally asserted that said affidavit was "completely inaccurate", without ever specifying any alleged inaccuracy. BOAC's Suppl. Memo., p. 12. The deposition transcripts now confirm the accuracy of each statement set forth in the Dillow affidavit. Each of those statements

is quoted below with citation to the corresponding testimony of the deponent in brackets.

"2. On Friday, July 30, 1976, Boeing deposed John R. Boulding. [Boulding Depo., p. i] At the time of the G-APFE accident in March, 1966, Mr. Boulding was Deputy Chief Inspector of Accidents at BOAC. [Boulding Depo., pp. 1, 4] Shortly thereafter, in November, 1966, Mr. Boulding became Chief Inspector of Accidents for BOAC and has held that position continuously up to and including the present. [Boulding Depo., pp. 1-4] The branch which Mr. Boulding has headed, the Accident Investigations Branch, was in charge of all incident and accident investigations involving BOAC aircraft and was charged with submitting monthly reports for those accidents to BOAC's Air Safety Committee [Folliard Depo., p. 3, 9, 21-22; Boulding Depo., p. 26, 32, 62] Mr. Boulding went to Japan in March of 1966 and participated in the accident investigation on behalf of BOAC." [Mr. Boulding was in Japan for 'nearly three weeks.' Boulding Depo., pp. 5,8]

"3. Mr. Boulding testified that as Chief Inspector of Accidents, he prepared BOAC Incident/Accident Report No. 558 (Boeing Exhibit D-1) and submitted that report to BOAC's Air Safety Committee with the recommendation that the accident file be closed. [Boulding Depo. pp. 21-22. Mr. Boulding's recommendation is set forth at page 9 of Exhibit D-1]. That recommendation was accepted by the Air Safety Committee; Mr. Boulding's report was published in BOAC's Air Safety Review dated August, 1967, and

the accident file was closed. [Nisbet Depo., pp. 14-15]. The BOAC Air Safety Review was, and still is, circulated to all BOAC management, captains and flight crews and to persons and entities outside of BOAC. [Folliard Depo., pp. 21, 35, 230-31, 356, 368].* Boulding further testified that in July of 1967, he submitted a report on the G-APFE accident to the International Air Transport Association pursuant to that organizations information exchange program. [Said report was marked deposition Exhibit D-1995, Boulding Depo. pp. 14-17, 27-28]. Thereafter, IATA circulated Mr. Boulding's accident report to its member airlines around the world. [*Id.*] A copy of that report is Boeing's Exhibit D-5."

"4. Mr. Boulding was specifically referred by Boeing's defense counsel to the following statement in his Accident Report No. 558 at page 5:

'The fin fitting was released to Boeing for detailed metallurgical examination and they concluded that these cracks were not an accident cause factor.' [Boulding Depo. pp. 36-37].

Mr. Boulding testified that he did not disagree with Boeing's conclusion, and that he knew of no other person who had ever expressed any disagreement with that conclusion. [Boulding Depo. p. 39] He further testified that he knew of no document that expressed any disagreement with that conclusion." [Boulding Depo. p. 37-38; Mr. Boulding testified as follows:

* The circulation of BOAC's Air Safety Review is described in greater detail in the other depositions of BOAC employees, copies of which have not yet been received.

"Q. Now at page 5 of Aircraft Incident/Accident Report No. 558, there is a statement contained in the fourth paragraph under the heading 'Examination of the aircraft wreckage' to the effect 'the fin fitting was released to Boeing for detailed metallurgical examination and they concluded that these cracks were not an accident cause factor. You wrote that, did you not?

A. Yes.

Q. Do you know of any writing that contains any facts or opinions which in any way conflict or disagree in whole or in part with that statement and, if so, would you please identify the writing?

[Objection omitted].

A. *I have not seen any.*

Q. I am asking you what you recall, and do you recall any person, and I want to know who he is or she is, who stated that the cracks in the fitting were a cause of the accident or who stated that they were relevant to the cause of the accident and, if so, I want to know who that person is.

[Objection omitted].

Q. Do you know of any person?

A. *I don't know of anyone.*

Q. Have you ever heard that there is such a person, whether or not you have spoken to the person?

[Objection omitted].

A. I am not aware of anybody who is voicing any opinion in this area at all.

Q. You have never heard that there was such a person?

[Objection omitted].

A. *No.*" Boulding Depo., pp. 36-37, emphasis added].

"5. On Monday, Tuesday and Wednesday, July 19, 20 and 21, 1976, Boeing's defense counsel deposed Ben J. Folliard [Folliard Depo. p. i]. Mr. Folliard was Chief Inspector of Accidents for BOAC at the time of the G-APFE accident, and retired from that position in November, 1966. [Folliard Depo. pp. 2-3]. During the depositions, counsel for BOAC designated Mr. Folliard as "the officer, director or employee of BOAC, or the former officer, director or employee of BOAC most knowledgeable with regard to the cause of the crash of the Boeing 707 aircraft, registration G-APFE, on or about March 5, 1966" pursuant to the notice of depositions filed by Boeing in this action on June 1, 1976.* Mr. Folliard testified that BOAC "accepted" the conclusion as to probable cause of the G-APFE accident reached by the Japanese in its offi-

* During Mr. Folliard's deposition, BOAC's counsel stated that Mr. Folliard was the present or former BOAC employee "knowledgeable" about the accident (Depo., p. 91) and that BOAC has *never* reached an opinion as to the cause of the accident. Depo. p. 94. Thereafter, during the deposition of Captain Miles, BOAC's counsel agreed with Mr. Miles' designation of Mr. Folliard as the present or former BOAC most knowledgeable as to the cause of the accident. Extract from Miles Deps., pp. 4-5.

cial report. [Folliard Depo. pp. 95, 97; Boulding Depo., p. 34].

"6. Mr. Folliard further testified that he requested the British Government, specifically its Royal Aircraft Establishment, to send an expert on aircraft investigation to Japan in order to investigate the G-APFE accident. [Folliard Depo., pp. 109, 266, 287].** Pursuant to Mr. Folliard's request, the Royal Aircraft Establishment sent F. H. Jones. [Boulding Depo., pp. 11-13]. Thereafter, Mr. Jones issued a report that sets forth his conclusion as to the probable cause of the accident. [Boulding Depo., p. 21]. Said report is Boeing Exhibit D-6. [*Id.*, said report was marked Exhibit D-1905 in the depositions].

"7. On July 29, 1976, Boeing deposed Captain T. Nisbet. [Nisbet Depo., p. i]. Captain Nisbet is presently Air Safety Advisor and Chairman of British Airways' Air Safety Committee, and has held that position since April of 1976. [Nisbet Depo., pp. 1-3]. At the time of the G-APFE accident, Captain Nisbet was general Manager of Flight Operations for BOAC. [Nisbet Depo., p. 1]. Captain Nisbet was referred to the following statement in BOAC's Incident/Accident Report No. 558 as follows:

'The fin fitting was released to Boeing for detailed metallurgical examination and they concluded that

** Mr. Folliard further testified:

"Q. Is there anyone at British Airways who had comparable expertise to Mr. Jones on wreckage analysis?

A. No."

these cracks were not an accident cause factor.' [Nisbet Depo., p. 87].

Captain Nisbet testified that he did not disagree with Boeing's conclusion and that he knew of no person who had ever expressed any disagreement with that conclusion. [Nisbet Depo., pp. 87-89.] He further testified that he knew of no document expressing any disagreement with that conclusion." [Nisbet Depo., p. 87.]

The BOAC deponents in London also authenticated each document relied on by Boeing in its motion for summary judgment. Those documents (Exhibits D-1, D-2, D-3, D-4, D-5, D-6, D-7, D-10) are listed below with the corresponding deposition exhibit number and the citation to the deposition testimony in which the exhibit is authenticated.

Boeing Exhibit No.	Deposition Exhibit No.	Authentication
D-1	D-1975, D-1981	Boulding Depo., p. 21 Nisbet Depo., p. 11
D-2	D-1972	Boulding Depo., p. 22 Nisbet Depo., p. 71
D-3	D-1972	Boulding Depo., p. 10 Nisbet Depo., p. 21
D-4	D-2001	Nisbet Depo., p. 77
D-5	D-1995	Boulding Depo., pp. 26-27
D-6	D-1905	Boulding Depo., p. 21

D-7	D-1984, 1986	Chambers Depo.*
D-10	D-1983	Boulding Depo., p. 34

PERKINS, COIE, STONE,
OLSEN & WILLIAMS
KEITH GERRARD
JOHN D. DILLOW
RICHARD C. COYLE

By /s/ JOHN D. DILLOW
JOHN D. DILLOW
Attorneys for Defendant
The Boeing Company

* As with Exhibits D-1 and D-4, Exhibit D-7 is an extract from an issue of BOAC's monthly publication, *Air Safety Review*, which was produced by BOAC's counsel at the London depositions. This issue was identified in the Deposition of E. Chambers.

DATED this 10th day of September, 1976.

BOAC's Supplemental Affidavit in Support of Plaintiff's Motion for Summary Judgment and in Opposition to Defendant's Motion for Summary Judgment

UNITED STATES DISTRICT COURT

WESTERN DISTRICT OF WASHINGTON AT SEATTLE

Nos. C74-257S and C74-380S

BRITISH OVERSEAS AIRWAYS CORPORATION,

Plaintiff,

v.

THE BOEING COMPANY,

Defendant.

State of New York,
County of New York, ss.:

RONALD E. PACE, being first duly sworn, deposes and says:

1. I am an attorney and counsellor at law associated with the firm of Condon & Forsyth, attorneys for the plaintiff British Overseas Airways Corporation (hereinafter BOAC). I have participated in the prosecution of these actions since their inception and am fully familiar with all of the prior proceedings heretofore had herein.

2. This Supplemental Affidavit is submitted, with the permission of this Court, in further support of BOAC's Motion For Summary Judgment against the defendant, The Boeing Company (hereinafter Boeing) and in opposition to Boeing's Summary Judgment Motion against BOAC.

BOAC's Supplemental Affidavit in Support of Plaintiff's Motion for Summary Judgment and in Opposition to Defendant's Motion for Summary Judgment

3. This Affidavit was prompted when on the day of oral argument, September 10, 1976, your deponent was served with portions of the transcripts of the depositions of certain BOAC witnesses who gave their depositions in these actions in London, England in July, 1976. The morning of September 10, 1976 was the first time your deponent had the opportunity to review these transcripts served upon him and with the Court's indulgence, your deponent was given the opportunity to respond to Boeing's Supplemental Memorandum In Support of Boeing's Motion for Summary Judgment, dated September 10, 1976 (hereinafter Boeing Supplemental Memorandum).

4. At the outset it should be stated that none of the witnesses, whose transcripts of their deposition, has been submitted to the Court by Boeing have reviewed, corrected where necessary and signed said transcripts. Moreover, the signing of each transcript of each witness before filing with the Court was *not* waived and thus the Court should not receive the transcripts of the depositions of Messrs. Folliard, Miles, Boulding and Nisbet. See Wright & Miller, Fed. Prac. & Proc. Civ. §§2118/2119. However, assuming *arguendo,* that the transcripts exactly as presented to this Court were signed by the respective witnesses your deponent will comment thereon with respect to the allegations and contentions postulated by Boeing.

5. In its papers in support of Boeing's Motion For Summary Judgment, great reliance is placed on the "Probable Cause" section of the Japanese Civil Aeronautics Board Accident Report (Exhibit No. 8 of BOAC's Motion For Summary Judgment and hereinafter JCAB Report) and

the insertion of portions and extracts of said Report in BOAC's Incident/Accident Report No. 558 (Exhibit D-1 to Boeing's Motion For Summary Judgment).

Firstly, the opening paragraph of the BOAC Incident/Accident Report No. 558 (hereinafter Report No. 558) sets forth the scope and purpose of the Report No. 558 as follows:

> "The official report on the accident to G-APFE near Mount Fuji 5.3.66 was recently published by the Japanese. Therefore, included in this report is a *summary* of the investigation together with extracts from the Japanese report." (Emphasis added.)

Then one must look not only to the "Probable Cause" section of the JCAB Report but the *entire* section, entitled "Conclusions", in which the "Probable Cause" section is included, which reads as follows:

> "a) Results of Investigation
>
> G-APFE was making a *normal flight* towards Mount Fuji till immediately before the accident in such *clear weather* that Mount Fuji could be seen from Tokyo.
>
> The evidence provided by the aircraft wreckage, the injuries to the victims and the evidence from the colour film *suggests* that the aircraft suddenly encountered abnormally severe gust loads exceeding the design limit load over Gotemba City and disintegrated in the air in a very short period of time.
>
> Although *it was impossible to forecast the existence* over Gotemba City *of turbulence sufficiently severe to*

> *destroy the aircraft and the investigation could not discover evidence which could verify meteorologically the existence of such turbulence,* it cannot be denied that turbulence *might* have become extremely severe, *if it is assumed* that a strong mountain wave system was present in the lee of Mount Fuji.
>
> b) Probable Cause.
>
> The probable causes of the accident is that the aircraft suddenly encountered abnormally severe turbulence over Gotemba City which imposed a gust load considerably in excess of the design limit." (Emphasis added.)

It was this entire section of the JCAB Report which was extracted therefrom and inserted in BOAC Report No. 558. The conclusions of the Japanese Civil Aeronautics Board, namely that (1) the BOAC aircraft was in normal flight, (2) disintegrated in air and (3) there was no evidence whatsoever to verify the existence of any turbulence at all, no less turbulence of such severity to cause the disintegration of a commercial airliner such as a Boeing 707, clearly shows that the "Probable Cause" in the JCAB Report is one based only on speculation, hypothecation and assumption; there was and is not one iota of factual evidence to support such a "probable cause" and thus, such a "probable cause" is totally inadmissible at trial as well as in Support of a Motion For Summary Judgment.

6. Incident/Accident Reports such as Report No. 558 are issued by the Air Safety Committee of BOAC. The

Terms of Reference of the Air Safety Committee, as set forth in the inside cover of the BOAC Air Safety Review in which Incident/Accident Reports such as Report No. 558 are published, state:

"TERMS OF REFERENCE OF THE AIR SAFETY COMMITTEE

The Air Safety Committee is responsible for

(i) considering all matters necessary to ensure safe operation of BOAC aircraft in the air and on the ground.

(ii) reviewing the circumstances of all 'reportable accidents and incidents' and other matters within BOAC to ensure that appropriate action is, or has been taken.

(iii) reviewing the standards of remedial and disciplinary action taken within the various departments.

(iv) comparing BOAC's safety record and procedures with that of comparable airlines.

(v) ensuring that Members of the Board of BOAC are adequately informed of the accident/incident situation and of the activities of the Committee."

7. It is manifestly clear that BOAC's Air Safety Committee, which reviews and publishes Incident/Accident Reports involving BOAC operations, (1) is not a conclusory body, (2) is not called upon to determine the cause of an incident and/or accident and (3) is not the body within the corporate structure of BOAC to enunciate and promulgate official company policy and position with regard to

incidents and/or accidents involving BOAC operations. As Captain Thomas Nisbet, who as Air Safety Advisor of BOAC heads the BOAC Air Safety Committee, stated:

"The air safety review is a vehicle through which we disseminate opinions of—it's thought to be for people who have some connection or interest in air safety. It does not mean we subscribe completely to everything that is written. Even if we publish a complete article written by someone who has some connection with the industry it does not mean we agree with every word, although the general sense of what is being printed might be very useful for our pilots to keep in mind. . . .

[W]e do make it clear from time to time that if anything appears in the air safety review in an article of this kind which appears to be in conflict with our standard drills and procedures as listed in the appropriate manuals and the manuals and our own drills and procedures supersede anything that may be written. We don't print a disclaimer of that kind in every copy of the air safety review but from time to time we do remind readers that the opinions and views and perhaps even suggestions contained in these articles are not necessarily in line with the British Airways policies. I think it is true to say that in most airlines safety organizations there was a large measure of agreement on most things, but not complete agreement on everything and we feel that we ought to disseminate as much relevant information to our pilots as we can, but always against the background of our

own operating procedures and the rules to which they must work." (Nisbet deposition pp. 82 and 83.)

8. The purpose of the Air Safety Review is the means by which descriptions of incidents and accidents which have occurred involving BOAC operations are promulgated as well as the promulgation of the action that has been taken to prevent recurrence. (Nisbet deposition p. 91.) What "action" was taken as published in BOAC Report No. 558 concerning the subject action?

"ACTION

Resulting from the discovery of the fatigue cracks in the fin attachment fitting, a world wide inspection was carried out on all 707 aircraft. Most airlines found that on some of their aircraft they had cracked fittings. On six of the 19 remaining BOAC 707 aircraft 10 fittings were found cracked. All cracks were in excess of the rework limit so the fittings were changed. On four of these aircraft both rear fittings were cracked.

In August 1966 Boeing issued Service Bulletin 2422 to introduce stronger fittings and to reinforce the bulkhead to which they are attached. All BOAC aircraft are not modified." BOAC Report No. 558.

No other "action" was taken or even recommended. Nothing was mentioned about even the possibility of severe clear air turbulence in and around isolated peaks such as Mount Fuji in Japan. Nothing was mentioned to even suggest a prohibition as to the future use of the authorized air-

way taken by the Captain of the subject aircraft. Accordingly, it is quite clear that BOAC most certainly did not adopt Boeing's convenient theory as to the cause of the accident in question but rather took action to remedy the defective and under-designed terminal fittings on all its Boeing 707 fleet, which is in complete conformity with Boeing's admissions as to the cause of the accident, namely that the vertical fin on the subject aircraft was defectively designed and failed under normal use. See Points III, IV and V of BOAC's Memorandum of Reasons and Authorities in Support of its Motion For Summary Judgment.

9. Moreover, Captain Nisbet did *not* testify that he did not disagree with the statement "the fin fitting was released to Boeing for detailed metallurgical examination and they concluded that these cracks were not an accident cause factor." Rather Captain Nisbet stated he could not recall having seen a document which specifically contradicted that statement. (Nisbet deposition pp. 87-88.) This does not mean that such documents do not exist. Further, Captain Nisbet stated, when asked if he knew of anyone at BOAC who held a contrary opinion, that he couldn't speak for what other people thought except that he had "no knowledge of anyone saying or expressing an opinion as to why this airplane got into trouble". (Nisbet deposition p. 89.)

10. Captain Nisbet went on to say that BOAC's first concern after the accident was to make sure their operational procedures were "right", and BOAC did so conclude that their operational procedures were "right" "safe

and satisfactory in every way". (Nisbet deposition pp. 89-90.) Captain Nisbet did recall quite specifically that he had heard of no criticism or even suggestion that there had been any failure on the part of an individual or on the part of BOAC concerning this accident. BOAC was completely mystified at the time of the accident as to the cause thereof. All that was known was that the aircraft crashed notwithstanding normal and safe operation; beyond that "there was a great deal of speculation but it was nothing more than that. We just did not know what the cause of the accident was." (Nisbet deposition p. 90.)

11. The publication of an incident/accident report in BOAC's Air Safety Review is to disseminate *factual* information concerning the incident and/or accident to those who have immediate and direct interest in reviewing the *facts* insofar as BOAC has been able to determine. (Nisbet deposition p. 96.) The fact that an incident and/or accident report is published in the Air Safety Review in no way indicates, implies or means that the Report is the official policy and/or position of BOAC. (Nisbet deposition pp. 96-97.) Said Captain Nisbet:

> "The policy for the flight operations department or division, as it was then, is determined by the senior management within the division or department. It is not determined by the air safety review.
>
> At the moment under our present organisation there is an operations policy group which meets as required, but usually at about monthly or six weeks intervals to consider what changes may be necessary in policy.

> That is the authority for the change in policy, that group, and it comprises the three flying general managers, namely general manager flight training who is responsible for training, general manager flight crew, who is responsible for discipline, and the general manager of flight technical services who is responsible for the technical operation of the aircraft and its operation within the environment. They will consider what changes, if any, may be necessary from time to time in the operations policies as applied and they would find expression—the changes will find expression in the flight operations division order. . . .
>
> It might help to clarify this if I were to describe the processes by which an accident or incident is dealt with. In the first instance the investigating officers working under the air safety adviser would gather together all the relevant facts and do whatever they can to preserve evidence such as flight data recordings and so on and will record all the facts as reliably as they can in a report. That report will contain a section headed "Conclusions" and these are in effect a short summary of the essential facts in so far as it's been possible to determine those. The report may also include recommendations which might help to prevent recurrence.
>
> The report in that state is then transmitted to the line manager concerned for his consideration. The line manager can disagree with any aspect of the report if he has reason to. He can accept or reject the recommendations. He can introduce additional mea-

sures of a corrective kind and, of course, he would be responsible for taking whatever disciplinary action he might consider appropriate. The entire executive authority in the matter rests with the line manager.

The function of the air safety adviser here is the gathering together and presentation of factual information for the line manager to use in deciding how to deal with the incident or accident." (Nisbet deposition pp. 97-99.)

12. BOAC did not and does not accept Boeing's theory as to the cause of the subject accident, i.e., severe clear air turbulence causing the aircraft to disintegrate, because in their years of experience flying commercial airliners, such as Boeing 707s, they had never encountered a situation or even heard of a situation where such aircraft had broken up or disintegrated in clear air solely as a result of meteorological conditions of any type. (Nisbet deposition pp. 105-106.)

13. Boeing, in their Supplemental Memorandum, dated September 10, 1976, refers to the deposition of Mr. John Gilbert Boulding of BOAC, the transcript of which has never been seen, corrected and signed by Mr. Boulding and thus, is inadmissible to Support a Motion For Summary Judgment.

14. At the time of the accident in question and during the entire investigation thereof Mr. Boulding was an assistant to Mr. Benjamin J. Folliard, BOAC's Chief Inspector of Accidents. (Boulding deposition pp. 4-5.) Mr.

Boulding's function in the investigation of the subject accident was a very limited and specific duty, namely observe the accident scene and the entire wreckage after it was assembled. That was the full extent of Mr. Boulding's involvement with the subject accident (Boulding deposition pp. 5-8).

15. Boeing alludes to the minutes of BOAC's Air Safety Committee with regard to BOAC Report No. 558 where the minutes say "It was noted that the cause of the accident was abnormally severe CAT which imposd excessive loads on the aircraft beyond its design limits". The minutes of BOAC's Air Safety Committee are not verbatim minutes but merely a secretary's summary of the discussions that transpired. No one reviews these minutes as they are not official statements of BOAC. Nor do they enunciate policy or position of BOAC with regard to incidents and/or accidents and the cause thereof. (Nisbet deposition pp. 71, 82-83; Boulding deposition pp. 23-25.)

16. Mr. Boulding, when asked a question by counsel for Boeing, whether he was aware of any writing which disagreed with the "Conclusions" extract from the JCAB Report, as inserted in BOAC Report No. 558, stated he had very little to do with the investigation and the contents of Report No. 558; all he did was compile BOAC's findings with the JCAB Report, which was accepted by Mr. Folliard as it had to be since it was the Japanese Civil Aeronautics Board and only they who had the ultimate responsibility and authority to investigate the accident. (Boulding deposition p. 34.) However, as Mr. Fol-

liard pointed out in his deposition, it is one thing to "accept" a report and another to "agree with" that same report. BOAC "accepted" the JCAB Report as they had no other alternative, but certainly did not "agree" with it, especially concerning the "Conclusions" and "Probable Cause" sections because this was merely pure speculation and guesswork. (Folliard deposition pp. .

17. Boeing, in its Supplemental Memorandum of September 10, 1976, refers to Mr. Boulding's deposition concerning the statement "The fin fitting was released to Boeing for detailed metallurgical examination and they concluded that these cracks were not an accident cause factor". (Report No. 558, p. 5). Mr. Boulding explained that the statement was "an extract from a signal or a document that we got from Boeing when we got their metallurgical report and I used that extract in this report". (Boulding deposition p. 37.) Mr. Boulding went on to say that as to the cause of the accident many things were discussed, including the fin fittings; the entire wreckage was discussed and it is impossible to recall what was said with reference to the cracks in the fin fittings and the cause of the accident. (Boulding deposition pp. 38-39.) Moreover, as has been established in Points III, IV and V of BOAC's Memorandum of Reasons and Authorities, Boeing concluded that the cause of the crash was that the vertical fin on the subject aircraft was defectively designed and failed under normal use.

18. Further, Mr. Boulding stated that he was not aware of anyone at BOAC voicing an opinion as to the cause of

the crash. (Boulding deposition p. 39.) This is so simply because BOAC at the time did not know the cause of the crash. (Nisbet deposition p. 29.) It was not until Boeing finally admitted its responsibility for the subject crash that the mystery was resolved. See Points III, IV and V of BOAC's Memorandum of Reasons and Authorities in Support of its Motion For Summary Judgment. Moreover, it is not coincidental that shortly after the accident Boeing refitted its entire 707 fleet, world-wide, with terminal fin fittings eight (8) times stronger than the fittings on the ill-fated aircraft and that BOAC's compliance with Boeing's Alert Bulletin 2422 was the only "action" taken by BOAC with regard to this accident.

19. Mr. Boulding's actions on behalf of BOAC with regard to any aspect of this accident and the investigation thereof can best be summed up by Mr. Boulding's own words:

> "Mr. Folliard visited my branch once he had left to do certain jobs in connection with FE. He came to look at files and to arrange for—I believe he went back to Tokyo in 1967 to finalise the report. But he had that event fairly well wrapped up and as I say I had a virtually new branch to run because the two men that came to work for me were new to the branch, so I was pretty well stretched at that time and *this was strictly his baby. I had very little to do with it. I acted as a bit of a post office once or twice on his behalf* but I believe he had two or three meetings with the Japanese but *I never had any meetings with the Japanese* other than the Japanese who was at ShellMex House, Mr.

Kaiho. That is the only one." (Emphasis added.) (Boulding deposition p. 46.)

20. Mr. Benjamin J. Folliard's deposition was also alluded to in Boeing's Supplemental Memorandum of September 10, 1976. Boeing attempts to persuade this Court that Boeing's theory of the accident, to wit: that aircraft G-APFE broke-up and disintegrated in clear air solely as a result of meteorological phenomena, was adopted by BOAC through Mr. Folliard when he testified that he "accepted" the JCAB Report.

21. When counsel for Boeing asked Mr. Folliard if BOAC "agreed" with the "Conclusions" reached by the Japanese Civil Aeronautics Board, Mr. Folliard stated: "We accepted them." (Folliard deposition p. 95.) This is *not* a difference without a distinction. To "agree" with something is to assent to it, concur with it. "Agree implies unison or complete accord often after a discussion or adjustment of differences." Webster's Seventh New Collegiate Dictionary (1967). "Accept" in the contest used by Mr. Folliard is to "endure without protest." Webster's Seventh New Collegiate Dictionary (1967); (Folliard deposition pp. 95—99, 104, 105, 106.) Said Mr. Folliard:

"Q. But it is fair to say that any part of the Japanese Report which BOAC disagreed with would have been pointed out to the Japanese?

MR. PACE: Objection

A. It would have been raised with them, but you must bear in mind that the Japanese were the overall authority for this investigation. Now I do not know how much experience you have had with them, but they are not easily changed in their attitude to some things, you know, to a point. If they are incorrect, they will accept it, but they do not bend with the wind." (Folliard deposition p. 105.)

22. Most importantly Mr. Folliard pointed out to counsel for Being that in his many years of experience investigating accidents he had never heard of "big" aircraft breaking up in flight solely as a result of turbulence. (Folliard deposition pp. 119, 374-375.) Moreover, as Chief Inspector of Accidents, Mr. Folliard after extensive investigation into this accident and after coordinating the efforts of the United Kingdom participants into the investigation did *not* make any conclusions as to the cause of the accident. (Folliard deposition p. 375.)

23. Lastly, Boeing refers to a report by F. H. Jones (Exhibit D-6). At the time of the report, October, 1966, perhaps Mr. Jones was unaware that the structural failure of aircraft G-APFE was associated with any "pre-crash weakness or malfunction". (Exhibit D-6, Summary.) However, Boeing was certainly aware of the association and attempted to camouflage it until Boeing testified under oath in depositions and their internal reports were made public. See Points II, III, IV and V of BOAC's Memorandum of Points and Authorities in Support of its Motion For Summary Judgment.

24. Furthermore, Mr. Jones states that the examination of the wreckage did not produce any evidence as to the

cause of the sideload which led to the disintegration of the aircraft. (Exhibit D-6, Summary.) This statement clearly refutes Boeing's theory of the cause of the accident. There is not one iota of evidence to support Boeing's theory that meteorological conditions caused aircraft G-APFE to disintegrate in flight where the weather between Tokyo and Mount Fuji was "fine, with no clouds and good visibility". (Exhibit D-6, p. 1.) The facts are clear and unrefuted:

1. Boeing designed and manufactured the subject aircraft when it was sold to plaintiff BOAC in 1960;

2. The subject aircraft was defective in both design and manufacture at the time it was sold to BOAC;

3. At and prior to the time the subject aircraft disintegrated in flight at an altitude of approximately 5000 metres when it was about seven (7) miles to the southeast of Mount Fuji:

(a) The subject aircraft was operating normally and properly pursuant to the regulations of the Japanese Civil Authority and pursuant to the operational and navigational guidelines set forth by BOAC in its manuals as well as pursuant to the Boeing Flight Manual.

(b) The subject aircraft was properly maintained in full accordance and compliance with all instructions issued to BOAC by Boeing.

(c) The meteorological conditions prior to and at the time the aircraft disintegrated were ideal; there was no cloud and there was good visibility. There is no proof of any kind to even suggest adverse or

abnormal meteorological conditions prior to, at the time of or even subsequent to the time the aircraft disintegrated.

4. The vertical fin on the subject aircraft was defective in design and manufacture and it was this defect in design and manufacture which caused the vertical tail fin of the aircraft to separate from the aircraft in flight, causing the aircraft to disintegrate in normal flight.

5. Commercial airliners such as the Boeing 707 are not supposed to break-up and disintegrate in normal flight and Boeing placed no restrictions as to the use and operation of its 707 aircraft such as the flight of the subject aircraft on the day of the accident. Moreover, Boeing never warned, advised or even suggested that its 707 aircraft could or would break-up in flight if encountering severe turbulence, as it now postulates without basis or foundation.

25. Boeing has not refutted and/or rebutted the established facts set forth above and in BOAC's Memoranda, Exhibits and Affidavits in Support of its Motion For Summary Judgment and their attempts to do so by affidavits and unauthenticated and unverified statements and contentions are fatally defective under Rule 56 of the Federal Rules of Civil Procedure. See BOAC's Supplemental Memoranda of Reasons and Authorities in Support of its Motion For Summary Judgment and in opposition to Boeing's Motion For Summary Judgment, dated September 3, 1976.

BOAC's Supplemental Affidavit in Support of Plaintiff's Motion for Summary Judgment and in Opposition to Defendant's Motion for Summary Judgment

WHEREFORE, it is respectfully requested that the Court enter an Order herein, pursuant to Rule 56, Federal Rules of Civil Procedure granting partial Summary Judgment in favor of plaintiff British Overseas Airways Corporation against defendant The Boeing Company on the issue of liability.

/s/ RONALD E. PACE
RONALD E. PACE

Sworn to before me this
15th day of September, 1976.

/s/ GLENN J. POGUST
Notary Public

GLENN J. POGUST
Notary Public, State of New York
No. 30 4607427
Qualified in Nassau County
Commission Expires March 30, 1977